FEBRUARY
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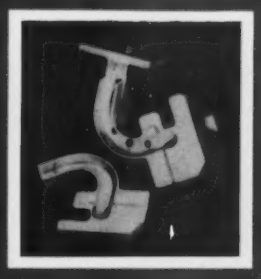
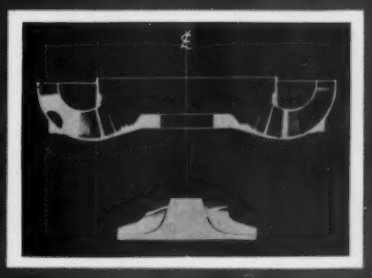
FOUNDRY

A PENTON PUBLICATION





Close-Tolerance Light Metal Castings

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I mull sand the new way...

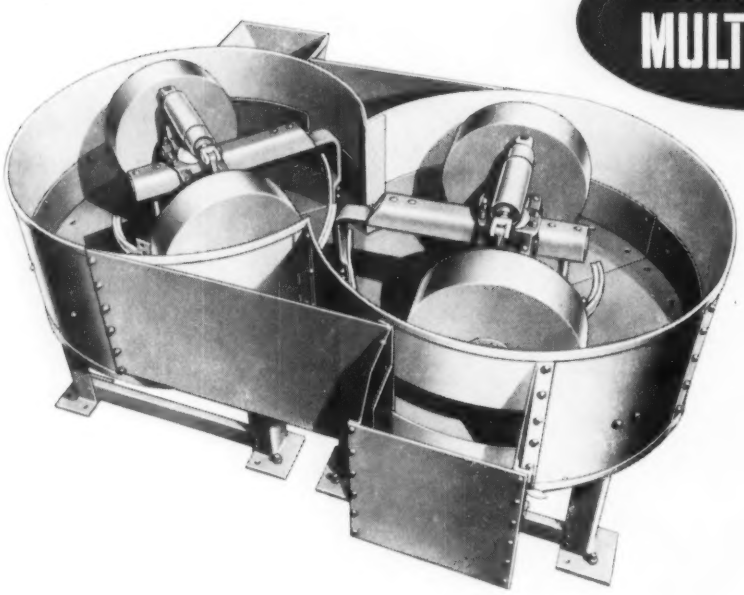
Continuously:

I do it carefully and thoroughly

and, I'm big enough or small enough

...to meet *any* molding requirement.

SIMPSON
MULTI-MULL



Foundrymen who are aggressively waging the battle of cost vs. quality are winning—with Simpson Multi-Mull.

Can you afford to overlook the competitive advantages of continuous and controlled mulling?

NATIONAL ENGINEERING COMPANY
646 Machinery Hall Building • Chicago 6, Illinois

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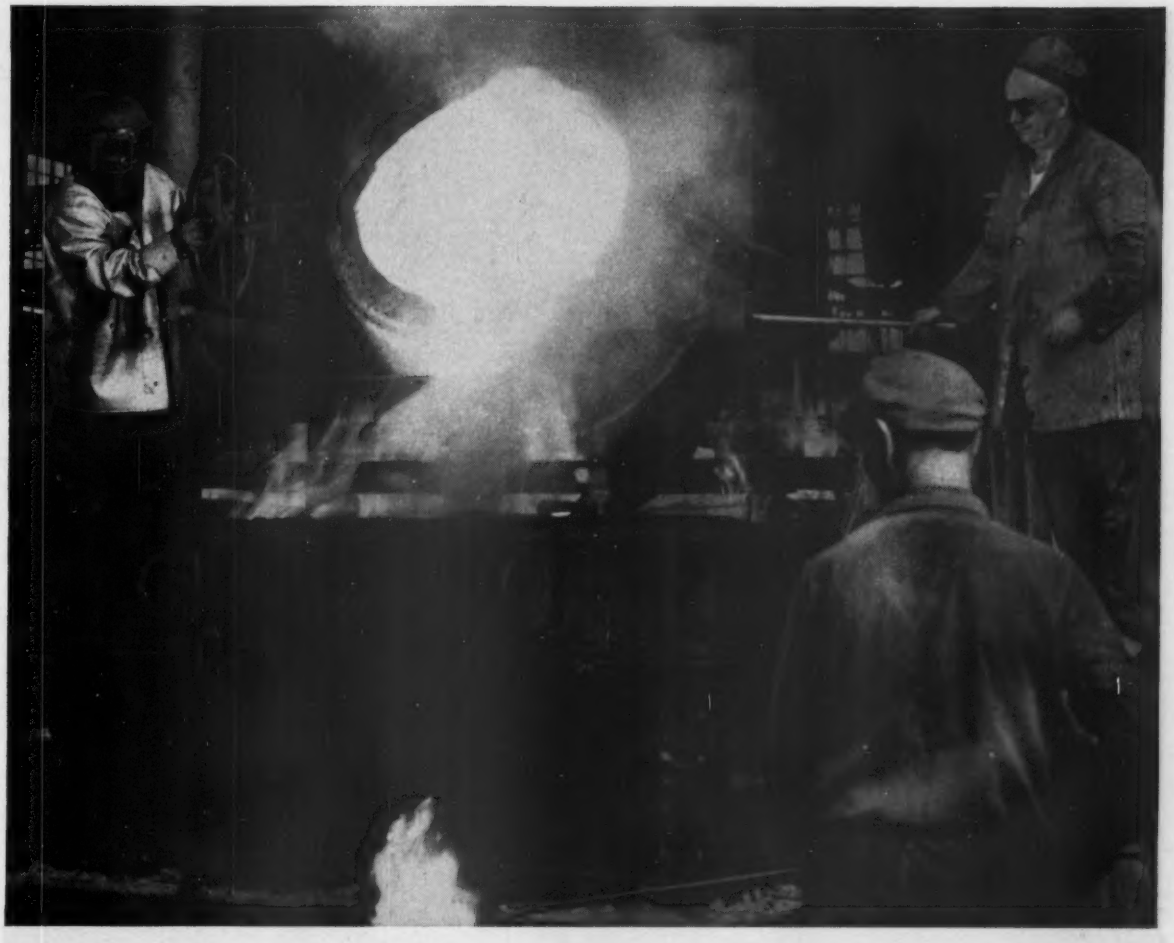

Make Sure of Your Melts with Inco Nickel

High-purity Inco Nickel can help you solve many casting problems, help you produce better castings.

For example, in gray iron castings relatively small Nickel additions will better the mechanical properties, reduce chill and promote uniform density in light and heavy sections. Nickel also improves machinability and induces a more uniform response to heat treatment.

Whether you produce iron, steel, nonferrous or heat- and corrosion-resistant castings—the chances are that you can improve them with Inco Nickel.

For help with casting problems, call the Inco Distributor or Inco District Office in your area. Their representatives will draw upon the experience of Inco—the world's largest producer and researcher of Nickel and its uses—to help you select the forms of Nickel best suited for your operations.

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INCO NICKEL

NICKEL MAKES CASTINGS PERFORM BETTER LONGER

Dimensional stability in intricate cores is achieved by Hills-McCanna, Chicago, through use of CB-40

Now a report from Hills-McCanna Company:

Good-rite CB-40 decreases blows, makes core baking far less critical

More on the new low-gassing mold and core binder, this time from Hills-McCanna Company, Chicago.

Low-gassing. Hills-McCanna reports a "decreased tendency for blows in small internal cores." This is a company that should know, since the intricate castings it makes for the aircraft industry have very complex coring. At the same time, Good-rite CB-40 provides excellent dimensional stability in the core, resulting in far closer tolerance in casting.

Easier baking. "Without decreasing core quality, we can use lower baking temperatures—and can operate without the concern for exact temperature created by other types of binder." Hills-McCanna also says that collapsibility is excellent.

Other advantages: At this foundry, bench life of Good-rite CB-40 has proved excellent. It can be used by any present method—is safe at all stages, will not burn, releases no objectionable fumes.

You can learn more: Write for complete information on Good-rite CB-40 to Department PD-1, B.F.Goodrich Chemical Company, 3135 Euclid Ave., Cleveland 15, O. In Canada: Kitchener, Ont.

Good-rite CHEMICALS

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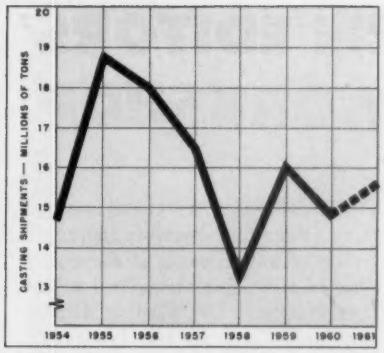

If the predictions of foundrymen about their operations in 1961 are realized (Page 23), the trend in castings shipments will be as shown above. Design engineers forecast an even larger increase in coming years (Page 106).

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FOUNDRY is edited primarily for management, production, technical, and purchasing personnel in foundries. A copy is sent at no cost to each metal casting plant in the U. S. and Canada employing 20 or more workers and to selected smaller foundries. Additional copies are sent to each foundry to the extent necessary to serve all key foundry personnel on a personal or routed basis. A limited number of copies is supplied at no cost to educational institutions. Subscriptions in the U. S., possessions, and Canada for home-addressed copies and copies not qualified for under the above principles: One year, $10. Single copy, $1. Other countries: One year, $20. Single copy, $2. Published monthly by The Penton Publishing Co., Penton Building, Cleveland 13, Ohio. Accepted as controlled circulation publication at Cleveland, Ohio.

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THE EDITORS' WORKSHOP

DIECASTING: An article in this issue (Page 69) describes the application of sound waves to diecasting. One of the papers presented at the first National Die Casting Exposition and Congress last November, it will be followed in coming months by a number of other Congress papers covering various aspects of diecasting practice.

SAFETY: Hamilton Foundry Inc., Hamilton, Ohio, is proud of its safety record—and justly so. For years, the accident rate at its plant has been well below the average of

both the foundry industry and all industries. What it takes to achieve such a record will be detailed next month in an article by Clarence W. Rowsey, Hamilton's director of personnel and safety.

CONTROL: Foundries seeking fast and accurate analysis of metal in the interest of improving quality control should investigate the instruments designed to help achieve this aim. An article in this issue (Page 120) tells how Westinghouse Electric employs an automatic x-ray spectrograph at one of its nonferrous foundries to analyze copper-base metal before pouring the castings. Our March issue will describe how Motor Casting Co., Milwaukee, uses a direct-reading spectrometer to analyze all of the control and residual elements in iron.

BINDERS CUT OUT FOR EVERY CORE PROCESS

1. BINDERS FOR EVERY CORE PROCESS: Featuring CHEM-REZ A-200, the chemically-reactive binder that "bakes" at room temperature; CHEM-REZ "100", with hot box curing, makes intricate cores at high production rates; LIN-O-SET, ADM's air-setting binder; ADCOSIL, for CO_2 gas-cured cores; ADMIREZ foundry resin for shell molds and cores; LINOIL and INDUCTOL, industry's most reliable oils for quality baked-sand cores.

Archer-Daniels-Midland company
FEDERAL FOUNDRY SUPPLY DIVISION
2191 West 110th Street, Cleveland 2, Ohio

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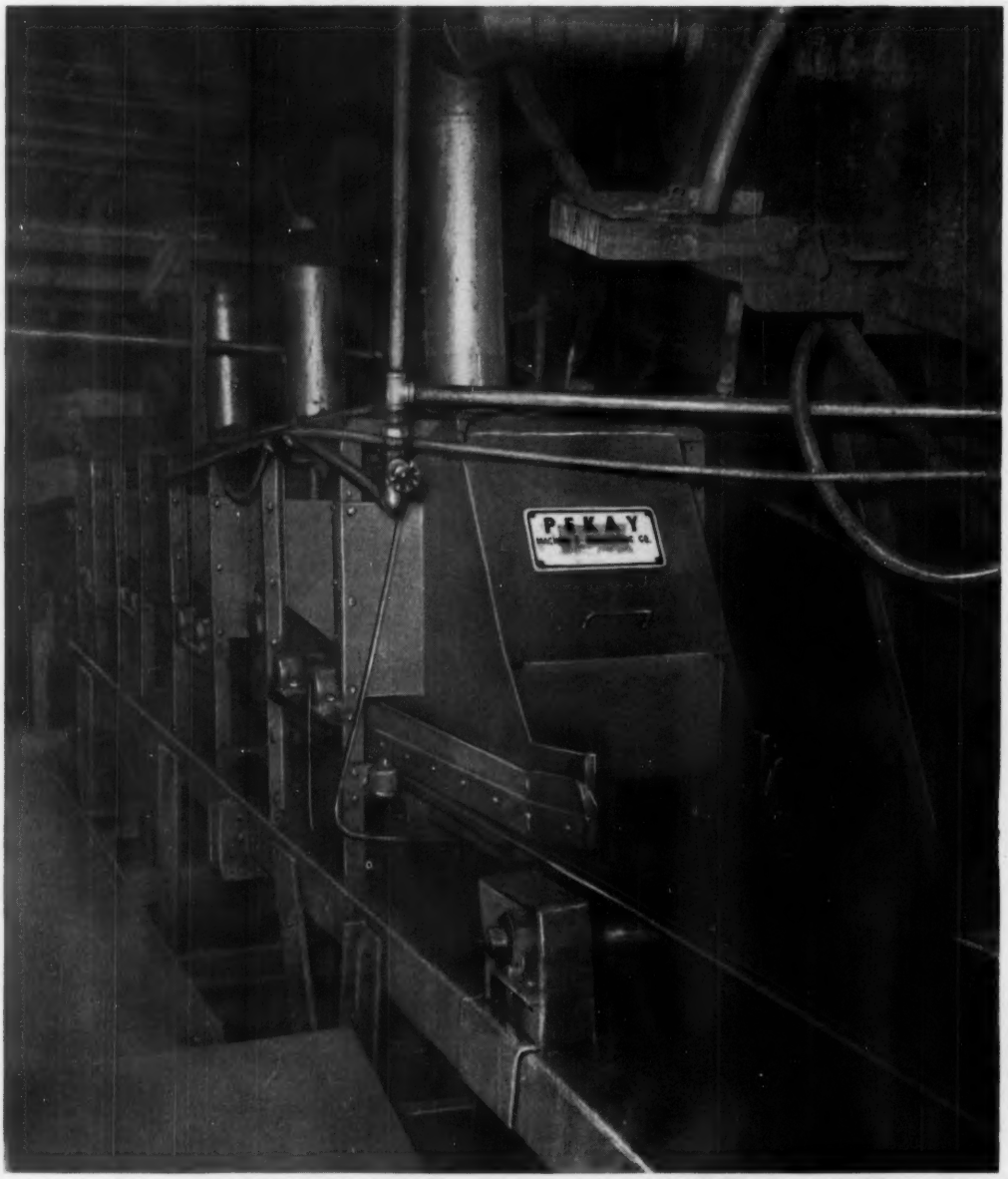
CONTINUOUS SAND

No Floor Space



Typical Pekay Mixer-Muller on inclined belt. It has a capacity of as much as 120 tons per hour.

CONDITIONING

Required!

COOLING
MIXING-MULLING
AERATING...

COOLING

Effective cooling with a Pekay Coolerator is accomplished in tonnages from 5 to 160 TPH. Sand can be stored cooled. The cooling of sand before mixing or mulling (and not while mixing and mulling) prevents the mulling unit from being compromised for a cooling operation.

MIXING and MULLING

Mixing and mulling in the Pekay Mixer-Muller is accomplished by repetitive mulling, cutting and mixing of sand in small increments on your conveyor belt. Mulling is done against rubber. The complete mixing and mulling operation is done continuously without footings and foundations for the equipment. Can also be used in conjunction with your existing mullers to increase sand capacity and quality.

AERATING

All mulling cakes are broken up and all sand is thoroughly fluffed by the Pekay Airator. This insures high permeability, even mold hardness, and reduction in defective castings.

Pekay Sand Conditioning Equipment cools, mixes, mulls and aerates in one continuous, uninterrupted operation. And by cooling sand where it should be cooled—*before* mulling, Pekay conditions all sand thoroughly. No valuable mulling time is wasted in cooling . . . you get the full benefit of a complete mulling cycle . . . rated mulling capacity is *delivered* capacity.

Continuous conditioning is *not* a new idea. It has been an accomplished, precisely engineered fact with Pekay equipment for nearly a decade. Dozens of installations*—in foundries of all sizes and types—are operating now in this country and abroad, and have been for years.

Yet for all their efficiency, Pekay Mixer-Mullers, Coolerators and Airators require *no* floor space, *no* expensive footings or foundations, *no* change in your present production facilities. All Pekay equipment is installed on your existing conveyors—in most cases over a single weekend. Downtime is practically eliminated . . . production is uninterrupted . . . waste of productive man-hours is minimized. The cost: only one-third as much as conventional equipment with the same rated capacity.

Pekay equipment can also be used in conjunction with your present facilities to increase your sand capacity by as much as 85%.

If you are interested in obtaining the benefits of truly continuous sand conditioning, fill in and mail the coupon or contact Pekay direct.

**List on request.*

PEKAY MACHINE & ENGINEERING CO., INC.

Pioneers and developers of continuous sand conditioning equipment for foundries. Used internationally.

2520 W. Lake St. • Chicago 12, Illinois

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- ☐ Pekay Mixer Mullers
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- ☐ Pekay Coolerator
- ☐ Pekay Airators

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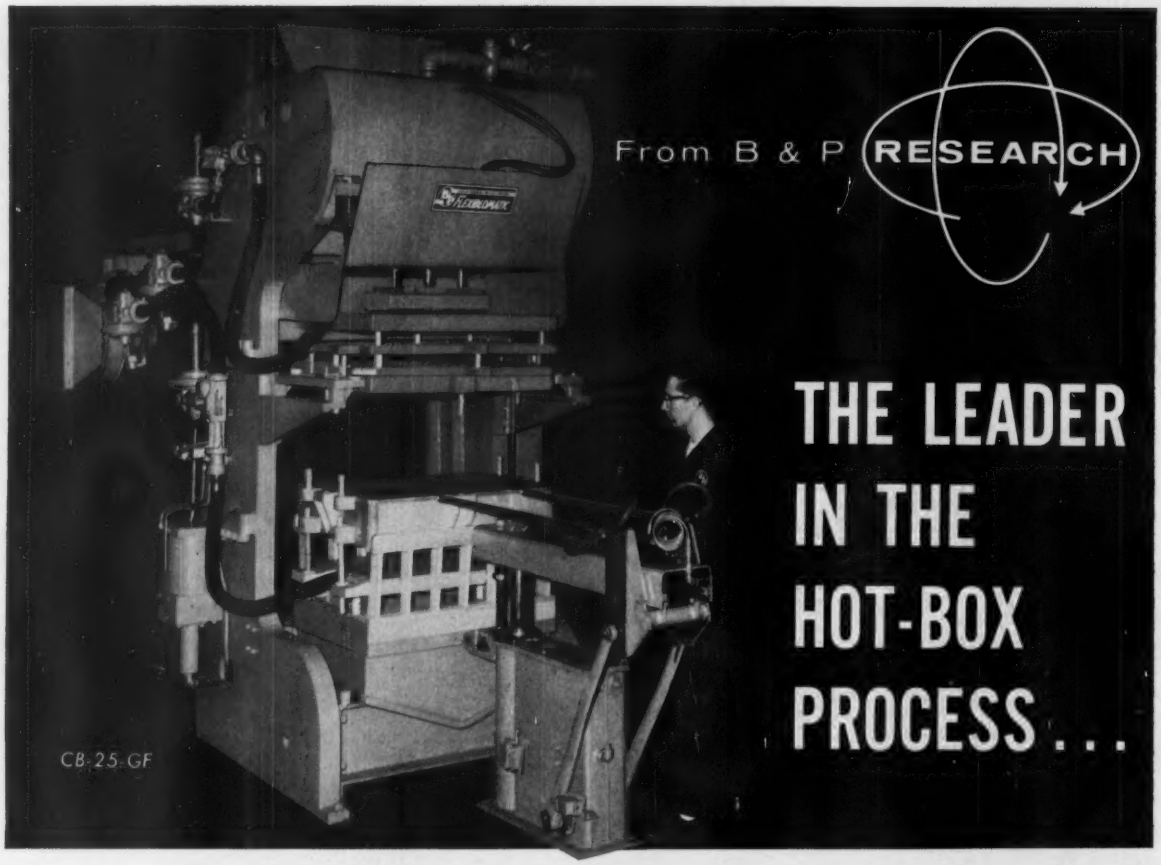

FLEXIBLOMATIC®

Big Cores or Small Cores, Here's a *Complete Line of Automatic Machines to Meet the Toughest Production Requirements

*Illustrated is the CB-25-GF, one of 17 Flexiblomatics of this size and model ordered by a major automotive manufacturer.

Only Beardsley & Piper with its vast research and development facilities could bring simplification of design plus top operating efficiency to the newest coremaking process in the industry—The Hot-Box Process. Ideal for all furfuryl-type binders, B&P's Flexiblomatic for the Hot-Box Process produces up to 140 cores per hour using a 15 second cure time. Production will, of course, be increased with reduced cure time . . . and a proportionate increase in cores is achieved through the use of multiple cavity core boxes.

Simplified, single station design means that the entire coremaking process is done in one machine—only one core box is required—there is no core box transfer—there is no double handling—and no rollover mechanism is necessary on the Flexiblomatic. These cost cutting features mean less initial cost, less gas consumption, and less square feet of floor space required. The fewer moving parts on the Flexiblomatic means less maintenance, too.

AUTOMATIC BLOW, CURE AND STRIP

In addition, the Flexiblomatic assures the best possible core through thermostatic temperature control of both halves of the core box. Automatic sequence control of blow, cure and strip eliminates error, assures uniform cores and minimum time cycles. Production is exceptional with single machine operation but even greater production efficiency can be attained with Flexiblomatic because one man can operate two machines.

Why not call in your B&P representative and get the complete story on the cost-cutting Hot-Box Process. This new process produces cores of outstanding dimensional stability and collapsibility and offers untold savings in time and materials . . . the Flexiblomatic affords optimum savings with the most efficient method of producing Hot-Box cores.

BEARDSLEY & PIPER
Div. Pettibone Mulliken Corp.
2424 N. Cicero Ave., Chicago 39, Ill.

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...Fluid Power news

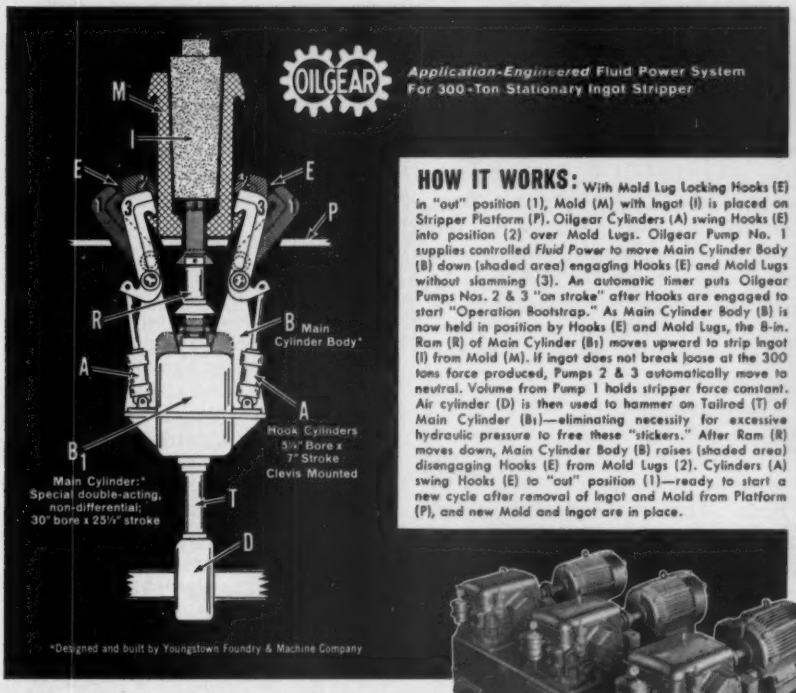
OILGEAR 40 Years of Fluid Power

From Oilgear *Application-Engineering* Files

HOW OILGEAR HEAVY-DUTY SYSTEM SIMPLIFIES POWER AND CONTROL OF 300-TON STATIONARY INGOT STRIPPER—HELPS ELIMINATE MAINTENANCE DOWNTIME

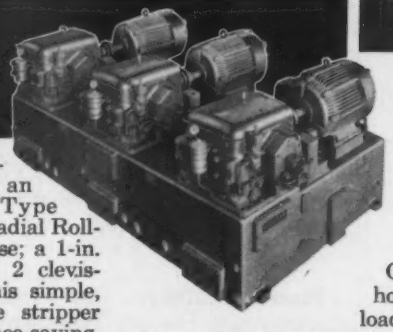
DATA: To replace a mechanical-type ingot stripper because of considerable maintenance downtime caused by dirt and foreign particles jamming the motor-driven ram screw—necessitating disassembly of the entire mechanism to free the threads. A hydraulically-powered, floor-mounted stripper design was approved as most convenient for the big-end-up molds used in this particular operation—would provide faster, easier maintenance accessibility at lowest over-all initial replacement cost.

Basic Power and Control Requirements: 1. Simplicity, and trouble-free, rugged dependability. 2. To be capable of many years of heavy-duty, rapid, 'round-the-clock operation with an absolute minimum of maintenance. 3. Must be: impervious to sand, scale, heat; compact; thrifty on electrical power input, wiring, installation downtime, floor space; completely free, if possible, from maintenance-provoking belts, chains, relays. 4. One source and responsibility for power and control systems preferred.



HOW IT WORKS: With Mold Lug Locking Hooks (E) in "out" position (1), Mold (M) with Ingot (I) is placed on Stripper Platform (P). Oilgear Cylinders (A) swing Hooks (E) into position (2) over Mold Lugs. Oilgear Pump No. 1 supplies controlled *Fluid Power* to move Main Cylinder Body (B) down (shaded area) engaging Hooks (E) and Mold Lugs without slamming (3). An automatic timer puts Oilgear Pumps Nos. 2 & 3 "on stroke" after Hooks are engaged to start "Operation Bootstrap." As Main Cylinder Body (B) is now held in position by Hooks (E) and Mold Lugs, the 8-in. Ram (R) of Main Cylinder (B_1) moves upward to strip Ingot (I) from Mold (M). If ingot does not break loose at the 300 tons force produced, Pumps 2 & 3 automatically move to neutral. Volume from Pump 1 holds stripper force constant. Air cylinder (D) is then used to hammer on Tailrod (T) of Main Cylinder (B_1)—eliminating necessity for excessive hydraulic pressure to free these "stickers." After Ram (R) moves down, Main Cylinder Body (B) raises (shaded area) disengaging Hooks (E) from Mold Lugs (2). Cylinders (A) swing Hooks (E) to "out" position (1)—ready to start a new cycle after removal of Ingot and Mold from Platform (P), and new Mold and Ingot are in place.

ABOVE: Oilgear-equipped Ingot Stripper "in action"—Mold Lug Locking Hooks (E) indicated. A 10,000-lb. ingot has just been "stripped" from the mold. Hooks (E) will be disengaged as soon as stripper ram is retracted.



LEFT: Oilgear Heavy-Duty "Power-Pak"—consisting of 3 Oilgear Type "DX-60" Variable Displacement, Two-Way Pumps on a single reservoir base used on this installation—is remotely located, isolated from heat and gritty particles present in the stripping area.

SOLUTION: An *Oilgear Application-Engineered Heavy-Duty System* consisting of an Oilgear "*Power-Pak*" incorporating 3 Type "DX-60" Variable Displacement, 2-Way, Radial Rolling Piston Pumps on a single reservoir base; a 1-in. solenoid-pilot-operated 4-Way Valve; and 2 clevis-mounted Hook Cylinders (A, above). This simple, direct-acting, locked-circuit, push-up-type stripper with remote speed and cycle control . . . space-saving, remotely located "*Power-Paks*". . . automatic pressure and flood lubrication with continuously filtered power fluid . . . positive, automatic overload protection—has eliminated maintenance downtime problems encountered with the previous mechanical stripper. Long life for continuous, 'round-the-clock production is assured by this automatic, "*Sealed-System*"—aided by the direct application of the pneumatic jarring cylinder to free "frozen" ingots. Lower installation cost, faster—easier accessibility for preventive maintenance are but two additional advantages of this Oilgear-equipped ingot stripper. USER STATES—"*Oilgear was selected because of its simplicity, and the trouble-free, long-life performance record of other Oilgear-equipped machines in our plants.*"

With Oilgear Heavy-Duty System Components designed for thousands of hours of continuous service at full rated load, savings are compounded with every hour of uninterrupted performance. That's why machinery and equipment manufacturers and *their* customers say . . .

"for the lowest cost per year . . . it's Oilgear!"

For solutions to YOUR linear or rotary Controlled Motion problems, call the factory-trained Oilgear Application-Engineer in your vicinity. Or write, stating your specific requirements directly to . . .

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Application-Engineered Controlled Motion Systems

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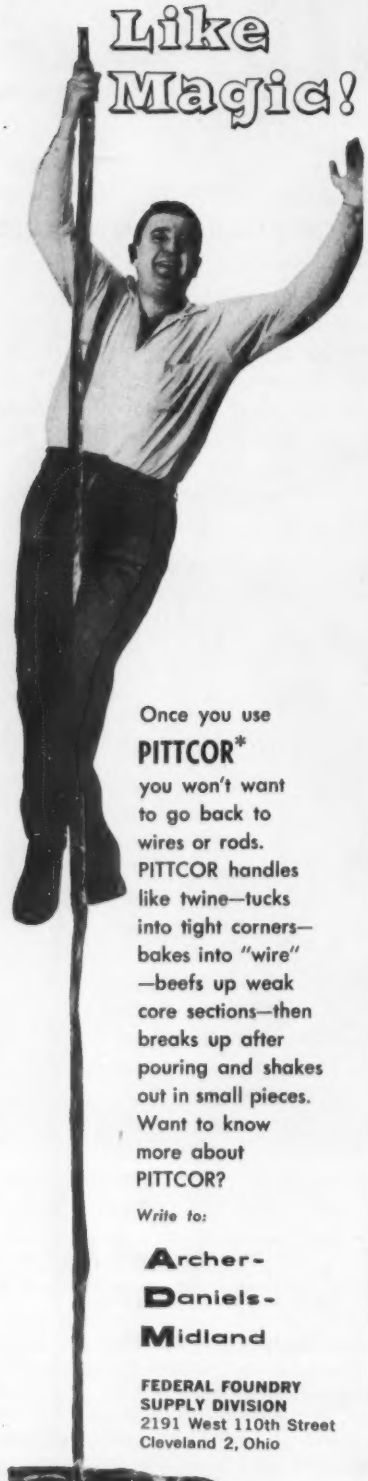
Like Magic!



Once you use
PITTCOR*
you won't want to go back to wires or rods. PITTCOR handles like twine—tucks into tight corners—bakes into "wire" —beefs up weak core sections—then breaks up after pouring and shakes out in small pieces. Want to know more about PITTCOR?

Write to:

Archer-Daniels-Midland

FEDERAL FOUNDRY SUPPLY DIVISION
2191 West 110th Street
Cleveland 2, Ohio

*Impregnated glass fiber roving

Circle 560 on Page 39

With the EDITORS

What Do We Read: Last month I commented on some of the Ad-Gage readership survey results from the September issue of FOUNDRY. Usually such studies are not made on succeeding issues, but in 1960, studies were made on both September and October issues. Results of the latter are now in, and provide some interesting information which we thought you might be interested in seeing.

The editors knew that shell cores is a hot subject among foundrymen, but they did not realize the breadth of interest. The readership study shows that 63 per cent of our readers found the special October report, "Shell Cores—How and Why They Are Used," of interest. Furthermore, the advertisement in that issue accorded the greatest interest concerned shell core equipment, and the ads of several other manufacturers of similar equipment were not far behind. Realizing the potentials of the process, foundrymen are securing every bit of information on the process.

Incidentally, the attention given the special report on shell cores is the biggest for any editorial article or series since the October, 1959, issue. Then the first of the series on "Gating and Risering," which was entitled "Principles of Gating" and was prepared by Prof. J. F. Wallace and Prof. E. B. Evans of Case Institute of Technology, received a 71 per cent interest on the part of readers.

Needless to say, both authors and editors are gratified when an article provides so much interest.

Russian Challenge: Our worthy contemporary, *Foundry Trade Journal*, published in London, presented editorials in the Sept. 29 and Oct. 6, 1960, issues entitled "The Challenge." These were prepared by Dr. J. G. Pearce, who retired in 1958 after 25 years as director of the British Cast Iron Research Association.

Because I believe that every reader in the USA as well as in other countries will find this a personal challenge, the Sept. 29 editorial is presented in this issue. The second will be presented in March.

"Much has been written about the challenge offered to the West by the USSR as a consequence of the wholehearted adoption of modern methods of training and of scientific investigation. Impressive evidence of individual technical achievements has been a Press commonplace in recent months, but apart from some scientific papers read (after translation) by the few specially interested, not a great deal of interest to the foundry industry has emerged. No missions have visited Russia to see progress in this field and consequently no reports have been made.

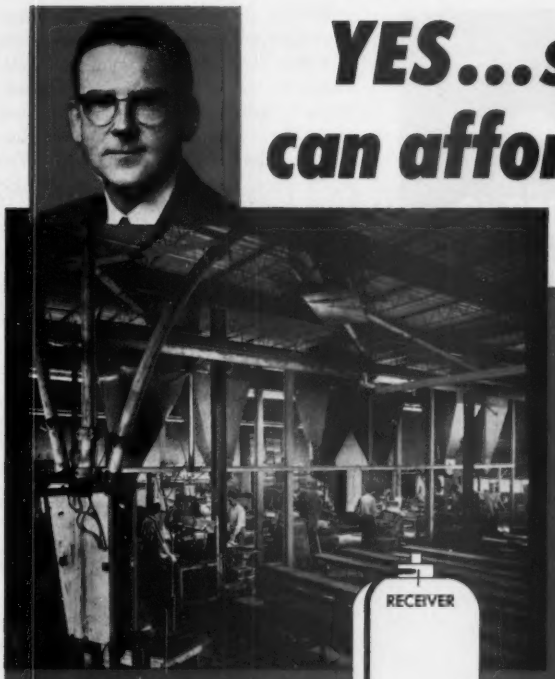
"A recent paper by Prof. Y. A. Hekhendzi, who occupies a Chair of Foundry Production at Leningrad, now available in translation, throws a good deal of light on many points. It leaves us in no doubt that the USSR has, or plans to have in the near future, foundry outputs which will make her, in relation to respective populations, comparable in importance with the leading producers in the Western world. It also leaves us in no doubt of the magnitude of the scientific research effort and of the output of trained personnel in this field. It shows that the USSR is fully alive to developments in the West and takes prompt action to follow them up and to improve on them.

"The output of castings in pre-revolutionary Russia was annually about half-a-million tons. The paper shows that an output of about 1,000,000 tons of iron and steel castings in 1926 increased to nearly 14,000,000 tons in 1959, with a further increase planned up to 1965, when the annual total will be 20,000,000 tons, of which 16,000,000 will be cast iron and 4,000,000 cast steel.

"The planned USSR output of 20,000,000 tons by 1965 with a population of the order of 208 millions, will then in all probability exceed the combined UK and USA outputs, where the combined populations will be of the order of 221 millions. This increase in USSR is heartening evidence of the future of the cast metals, but at the same time, it is formidable demonstration of industrial growth, and it may be well to devote a little further space to the policies on which it is based.

"Meanwhile, the writer should add that while the paper shows complete familiarity with Western developments, its many

YES...small foundries can afford mechanization



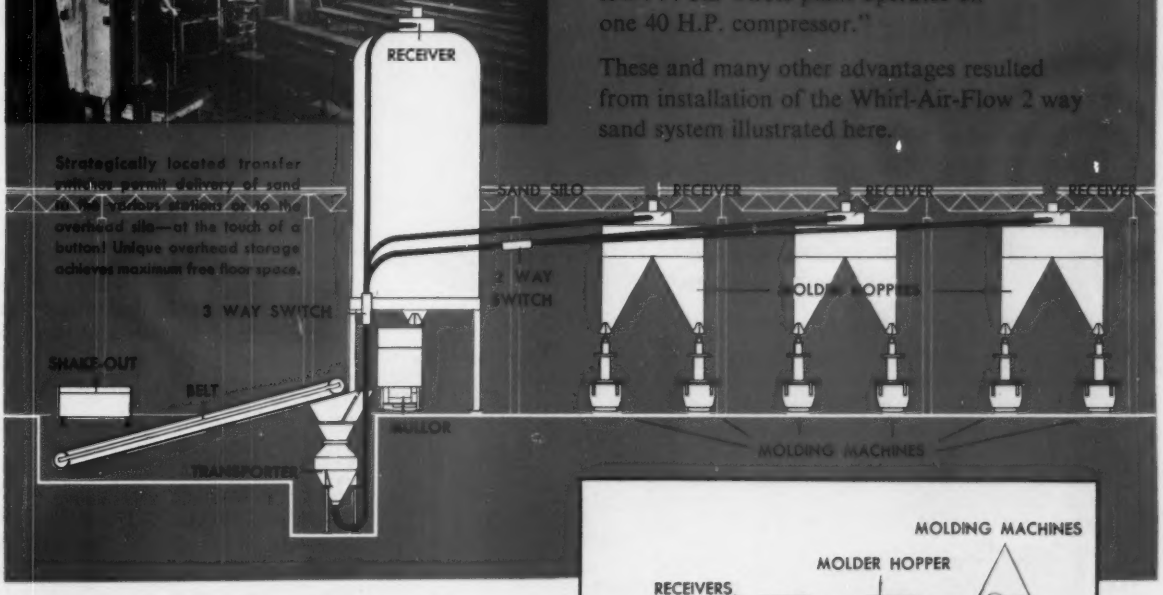
states Frank Ryan, President, St. Paul Brass Foundry, St. Paul, Minnesota

"Here is a summary of our savings over our previous operation.

40% Saving in sand handling labor
15% Saving in molding labor
15% Less scrap.

And we find air consumption extremely low . . . our whole plant operates on one 40 H.P. compressor."

These and many other advantages resulted from installation of the Whirl-Air-Flow 2 way sand system illustrated here.

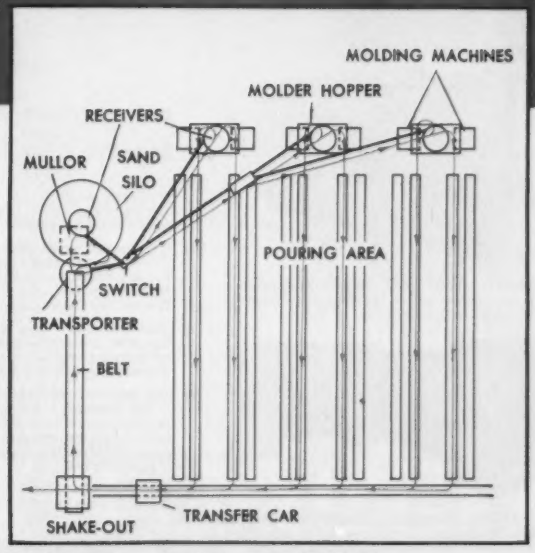


BETTER SAND PROPERTIES...

. . . result from Whirl-Air-Flow delivery. The performance results are shown below:

	BEFORE TRANSPORTING	AFTER TRANSPORTING
Moisture	3.0%	3.0%
Green Compression	15 P.S.I.	16 P.S.I.
Permeability	21	23

TELL US YOUR HANDLING PROBLEM—Let us show you how Whirl-Air-Flow can boost your production and reduce costs in your plant.



WHIRL AIR FLOW PNEUMATIC CONVEYORS

WHIRL-AIR-FLOW

650 25th Ave. S. E. Minneapolis 14, Minn.

Circle 561 on Page 39

AUTOMATE your melt analyses with a

BA DIRECT-READING SPECTROMETER

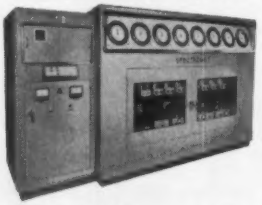
Chemical Composition In Minutes

Baird-Atomic Spectrometers — either the SPECTROMET® or DIRECT READER — allow high precision analysis of alloying and minor elements to be made quickly and easily. Results are reported to the melt shop in minutes permitting corrections to be made prior to pouring. Both units are specially designed for rugged, practical use . . . to be operated by semi- or non-technical personnel.

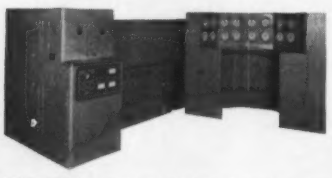
SAVE TIME, ELIMINATE WASTE, HIT SPECS ON THE NOSE

- Eliminate "off analysis" heats.
- Shorten furnace holding time — net more heats per month, minimum loss of alloy elements, longer furnace life, lower fuel costs.
- Conserve expensive alloying elements by confidently aiming at low side of the specification. Detect harmful tramp elements.
- Reduce expenses by saving manpower, supplies, and space.

Choose the Model Suited to Your Needs



SPECTROMET—rugged model designed for installation close to the melt shop without need for special laboratory. Analyzes up to fourteen elements.



DIRECT READER—Custom-built laboratory unit analyzes for up to 60 elements or more — dial or strip chart readout.

BOTH UNITS HAVE THESE EXCLUSIVE BA ADVANTAGES

- Automatic Optical Servo Monitor — maintains optical alignment regardless of temperature, atmospheric pressure or shock and vibration.
- Simultaneous Results with Parallel Interchangeable Channels — essentially a separate direct reader for each element. Increases reliability, facilitates maintenance. If one channel fails, other channels not affected. Channels interchangeable without recalibration.
- Wide concentration range on single scale — exclusive logarithmic presentation of results covers wide concentration range on one scale without sacrifice in precision (e.g. from .1% to 40% chromium in steel).
- High Resolution and Dispersion with 3-Meter Grating — high dispersion of grating in combination with Automatic Optical Servo Monitor aids performance. For example: phosphorus in steel in presence of copper, boron in steel, silicon in steel in presence of high chromium.
- Custom Built Excitation Source — the source best suited to each problem is custom built into the instrument.

Write for Introductory Bulletin SC-1.

BA BAIRD-ATOMIC, INC.

33 university road · cambridge 38, mass.

references are solely to Russian sources. Appreciation, however, is accorded to the fact that the American professor, H. M. Howe, in the early years of the present century, dedicated his book, "Iron, Steel and Other Alloys," to the famous Russian metallurgist, D. C. Tschernoff. Too much stress should not be laid on this avoidance of other Western references, since the paper is intended to be about USSR and concludes with a general expression of the value of closer contacts and exchange of experience."

Research Sparkles: American Steel Foundries, Prudential Plaza, Chicago, has sent me a copy of its new 40-page booklet entitled "ASF Laboratories." This booklet is beautifully illustrated, and includes the four-color reproduction of a number of paintings of laboratory scenes.

The text discusses the laboratories as development sources for American railroads, and features the Product Development Laboratory of Granite City, Ill.; the ASF Service Laboratory, which is a unique test train; the Manufacturing Research Laboratory at East Chicago, Ind.; the Coupler Development Laboratory at Alliance, Ohio; the Engineering Development Laboratory at Hammond, Ind.; and the Griffin Wheel Co. research facility at Bensenville, Ill.

Congratulations to ASF on an excellent job.

Index Ready: If you bind your copies of FOUNDRY, or if you want to get an idea of the broad field of subjects covered by this publication in the course of a year, send your request for a copy of the 1960 editorial index. It is free.

Executive Committee: Editor Bill Gude was elected a member of the executive committee of the Society of Business Magazine Editors at a meeting in Washington, Dec. 1.

Congratulations, Bill.

With the end of the annual holiday lull, the editors of FOUNDRY are hitting the road again to find interesting, worthwhile material for our readers during 1961.

They'll be visiting plants and attending meetings from coast to coast to gather information that will help foundrymen produce better castings and enjoy greater prosperity. See you around!

F.G.S.

Circle 562 on Page 39

An Eastern Foundry Conveys and Cools 120 Tons per Hour of Sand with Simplicity "VS" Conveyor

The Simplicity model "VS" conveyor shown moves hot sand from two shakeouts, up a three degree incline, to an elevator at an average rate of 80 tons, with a peak load of one hundred twenty tons per hour. As the sand moves along the conveyor deck, water is added and plows turn the sand thus reducing the sand temperature one hundred degrees. The sand is discharged from the conveyor into the elevator boot over a permanent magnet which removes all of the metal particles.

Simplicity conveyors have proved efficient for transferring materials such as sand and castings, from one point to another. Feed points can be positioned along the length of the conveyor, and materials transferred to a common discharge point.

"VS" conveyors are available in widths from 12" to 36" and in lengths from 10' to 60' with one drive assembly. At customer request, these conveyors can be equipped with liners, covers, or can be built in two surface units.

Write for catalog C-1 which describes the various models of Simplicity Conveyors.

Simplicity
TRADE MARK REGISTERED

ENGINEERING COMPANY • DURAND 7, MICHIGAN

SALES REPRESENTATIVES IN ALL PARTS OF THE U.S.A.
FOR CANADA: Simplicity Materials Handling Limited, Guelph, Ontario.
FOR EXPORT: Brown & Sites, 50 Church Street, New York 7, N. Y.

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Circle 563 on Page 39

FROM CATERPILLAR—

An announcement about a new line of wheel loaders for all types of bulk material handling

These new machines—Caterpillar wheel Traxcavators—will likely more than meet your requirements of maneuverability, safety, speed *and* production—should set new standards of output, handling costs and dependability in your plant.

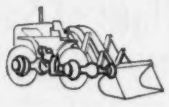
For a year now they've been at work in industrial plants, quarries, aggregate plants, coal stockpiles and construction. There has been unprecedented praise from their new owners . . . confirming seven years of development and testing.

And there's more behind these Traxcavators than painstaking development: they are built by a manufacturer with 23 years' experience in loaders, twenty years' know-how with heavy wheel tractors and more than a half-century background in building the finest construction and earthmoving equipment.

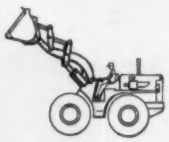
HOW ARE THEY DIFFERENT?

The difference begins with our basic design and manufacturing concept. It's not enough just to build a machine that can deliver satisfactory production for its owner. For a machine to be a "good buy" it must be able to produce at low cost over a long period of time. That's why we build machines to withstand the toughest work in the world . . . and with an endurance margin to boot.

The difference is most obvious in the Traxcavators' performance, and look at the reason for it. A Traxcavator operator is a fortunate man. He mounts his machine by going up three wide steps, no climbing over tires or struggling up ladders. There are fenders to protect him. The operator's area is arranged to make him comfortable, confident. Power shift transmission, automatic bucket positioners, power-boosted steering and brakes do the hard work for him, let him give his attention to handling the material. He can see where he's going and he can see what he's doing. Visibility on a Traxcavator is excellent, unsurpassed.



Safety men notice that the bucket lift arms and hydraulic pistons are all in front of the operator; he's not worried by mechanisms moving up and down on each side of him. And putting the bucket lift arms in front of the operator gives Traxcavators extremely long reach to fill hoppers and bins several feet from the machines: The smallest Traxcavator, the 922, reaches out nearly three and a half feet with a maximum lift over 11 feet . . . the 944 over four feet . . . and the 966, largest of the machines, reaches nearly five feet, lifts nearly 13 feet.



There are buckets to handle any weight or type material. There's a side-dump bucket that permits the Traxcavator to operate in areas even too narrow to turn—a feature offered exclusively by Caterpillar. There are fiber-glass cabs for cold weather operation. There are forks for palletized materials and always special configurations available to fit your needs.

WHAT ABOUT POWER?

Cat wheel loaders offer a choice of Caterpillar Diesel Engines or gasoline engines on the two smaller models.

922—1¼ cu. yd. standard bucket—80 HP

944—2 cu. yd. standard bucket—105 HP

The big 966 is powered by a Caterpillar D333 turbocharged Diesel Engine.

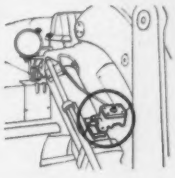
Cat 4-cycle Diesels have long been famous for their dependability and simple maintenance. They run on economical furnace oil—will burn premium fuels, too, but they're not required. They have optional independent gasoline starting engines for sure starts in outside winter operations. Easy, direct-electric starting is standard.

ARE THEY MANEUVERABLE?

They're unsurpassed. Power steering on all three loaders twirls them around in a 21′ turning radius, yet gives sure control for high-speed traveling. The 966 offers dual-ratio steering which allows full turns with only a half turn of the wheel, plus safe, automotive type control for highway travel.

Aisle space? The 922 needs only seven feet; the two larger machines slightly more.

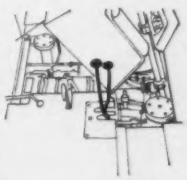
Dual brakes on all three Traxcavators give operators a choice of braking the machine with transmission engaged, or, using the other pedal, stopping the machine *and* disengaging the transmission . . . allowing full engine power to go into the hydraulics.



Maneuverability is increased by the automatic bucket controls, too; a quick touch on a control lever automatically sets the bucket at the correct loading angle; a push on the other lever starts the bucket up; it *stops* automatically at a pre-set carry position. This is all done *for* the operator; he can give plenty of attention to maneuvering the Traxcavator to get the material moved quickly.

These features make good operators all the better and they help the owner, too. If a machine is easy to control, the operator will get more of the work potential out of the machine at the end of a shift as well as at the beginning.

HOW IS THE SERVICE?



Caterpillar Dealers are accustomed to providing service around the clock and around the countryside. Our earthmoving customers go where the work is. And they expect service *wherever* they are. And they expect it fast. Cat Dealers have a reputation of seeing that they get it. It's expert service, too, because these servicemen are thoroughly trained. They know the machines they work on, and they know how important it is that those machines keep running.

Genuine Cat parts are always available. The Traxcavator you buy today will have a parts stock behind it as long as you're using that machine.

WOULD YOU LIKE MORE INFORMATION?

We'd be happy to send you more information and complete specifications on any or all of the new Caterpillar wheel loaders. Just send in the coupon, or, better yet, look in the Yellow Pages and call your nearby Caterpillar Dealer. You'll meet a man with some good answers to material handling problems and some surprisingly good news about the low cost of wheel Traxcavators.

Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.

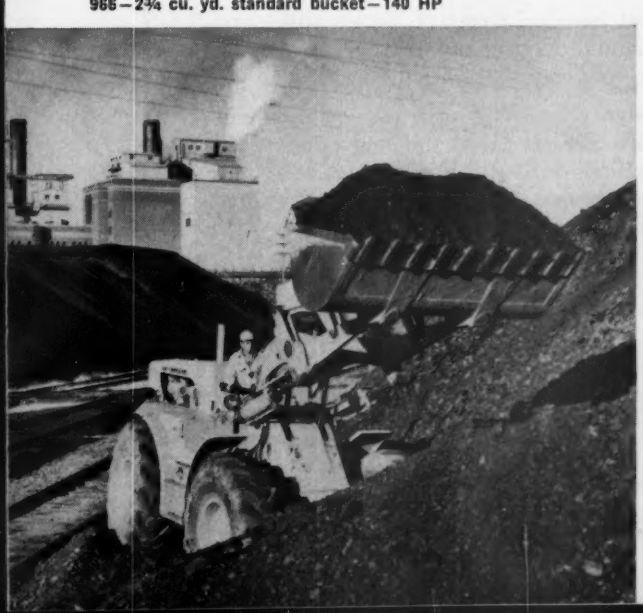
CATERPILLAR

Caterpillar, Cat and Traxcavator are Registered Trademarks of Caterpillar Tractor Co.

TRAXCAVATORS ARE MAKING OTHER LOADERS OBSOLETE

Circle 564 on Page 39

966—2¾ cu. yd. standard bucket—140 HP



CATERPILLAR TRACTOR CO.
Dept. L-192, General Offices, Peoria, Illinois, U.S.A.

Gentlemen: Please send me information on Traxcavator wheel loaders for industrial bulk materials handling.

I am particularly interested in the _____ (model number)

for handling _____ (names of materials regularly handled)

_____

We presently use: _____ (type of equipment) (model)

_____ (bucket size or capacity)

Name _____

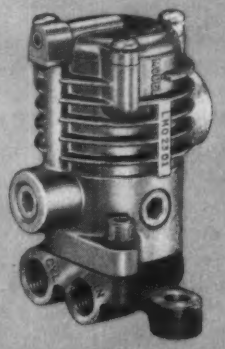
Title _____

Company _____

Address _____

City _____ Zone _____ State _____

Telephone _____ Extension _____

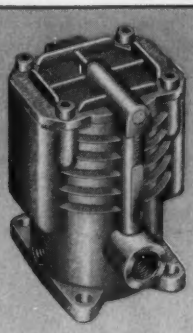


SPEED KING L Series pilot; 2 & 3-way NO & NC; foot, subbase or manifold mounting; 1/16 to 1/8 in. orifices. Subbase mounting shown.

SPEED KING L Series pilot manifold; for 2 & 3 WAY NO or NC pilots; 2, 3, 4 or 5-station, 1/4 in. NPT cylinder ports. 5-station shown.

for dependable, economical control, specify versatile...

SPEED KING®
SOLENOID PILOTS



SPEED KING P Series pilot; 2 & 3-way NO & NC, 4-way; foot, subbase or manifold mounting; 1/8 or 3/16 in. orifices. Foot mounting shown.

Compact Valvair® SPEED KING pilots are ideal for control of small air or vacuum-operated devices including cylinders up to 3 in. bore, as well as for piloting larger valves. Featuring Valvair's flow-thru cooling design, they offer multi-million cycle dependability, with solenoid coils guaranteed against burnout for the life of the valve. Choose from a full range of types, mounting styles and sizes; integral junction boxes (L Series only) and manual override optional; coils for ac or dc, any voltage.

Solve your small unit control problems with SPEED KING solenoid pilots. Your Bellows-Valvair Field Engineer can recommend a size and type exactly suited to your requirements.

Write for free Bulletin PIL. Address: Bellows-Valvair, Akron 9, Ohio. Dept. FO-261

8162

NFPA NATIONAL FLUID POWER ASSOCIATION

Bellows-Valvair

AKRON 9, OHIO

DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

LATE NEWS

SCRAP STRONGER: Iron and steel scrap prices have tended upward since the year-end. Reflecting only moderate demand from consumers, however, the market remains well below levels of a year ago. For instance, steel-making grades are quoted as much as $10 to $12 a ton less than in early 1960. The average price for No. 1 cupola cast in five leading centers — Birmingham, Chicago, Cleveland, Philadelphia, and Pittsburgh—recently was $38.50 a ton. A year ago it averaged $51.

ALUMINUM ANNIVERSARY: Annual meeting of the Aluminum Association will be held Feb. 15-17 in Cleveland, instead of in New York in January, as it usually is. The change makes the meeting coincide with celebration of the 75th anniversary of the discovery of the electrolytic process of aluminum reduction by Charles M. Hall at Oberlin College, Oberlin, Ohio, near Cleveland, and permits members to make a pilgrimage to Oberlin College. A special program planned at Oberlin on Feb. 16 will include roundtable discussions of aluminum applications. Other features will be the announcement of a permanent memorial exhibit in the Oberlin Hall of Science, now under construction, and a banquet.

MEXICAN FOUNDRY: American Brake Shoe Co., New York, and Teziutlan Copper Co., of Mexico, have joined to form a million-dollar foundry subsidiary, Amsco Mexicana, S. A., which operates a foundry at Tlalnepantla, near Mexico City. The modernized plant can produce more than 400 tons of steel castings per month. Its output will go to the Mexican construction, mining, cement and other heavy in-

Foundry Statistics

Iron and Steel Scrap Consumption

(Gross tons*)

	All Scrap Total	By Types of Furnace — Cupola Total	Air Total	Electric Total
1958	50,242,746	7,725,970	821,388	7,152,726
1959				
Aug.	1,875,165	691,786	81,184	374,678
8 mo.	42,780,391	6,555,629	756,367	6,536,053
Sept.	2,114,015	801,588	99,090	441,134
Oct.	2,266,709	798,569	98,279	445,137
Nov.	4,796,896	614,233	82,784	801,555
Dec.	7,021,870	843,040	99,577	1,008,158
Total	58,979,881	9,613,059	1,156,097	9,232,037
1960				
Jan.	7,043,488	823,442	95,442	1,058,159
Feb.	6,493,558	822,476	97,688	1,015,716
Mar.	6,655,569	839,016	106,749	974,535
Apr.	5,625,717	754,486	82,767	787,186
May	5,051,121	771,800	79,170	652,585
June	4,485,444	809,297	87,485	633,797
July	3,678,127	603,062	55,974	520,361
Aug.	4,217,762	692,470	78,788	692,471
8 mo.	43,250,586	6,116,049	684,063	6,334,810

Index of Foundry Equipment Orders

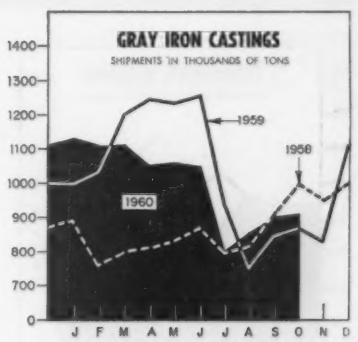
Foundry Trades Only

(Net Orders Closed, New Equipment)

	1959	1960
Jan.	127.4	95.5
Feb.	237.1	128.6
Mar.	166.6	159.9
Apr.	154.2	97.9
May	157.0	159.0
June	125.1	164.8
July	110.7	80.0
Aug.	134.1	92.4
Sept.	131.3	158.1
Oct.	140.8	81.7
Nov.	131.2	106.5
Dec.	95.9	....

Note: Base period 1947-49 taken as 100 per cent monthly average.

Source: Foundry Equipment Manufacturers Association.



GRAY IRON CASTINGS—SHIPMENTS

(Net tons[1])

	All Castings—Total	All Castings—For Sale	Miscellaneous Castings Total	Miscellaneous Castings For Sale	Nodular Iron Castings Total	Heavy Steel Ingot Molds Total	Chilled Railroad Car Wheels Total	Pressure Pipe & Fittings Total[2]	Soil Pipe & Fittings Total[3]	Unfilled Orders[4]
1958	10,357,504	5,849,426	6,146,186	2,648,005	117,558	1,884,396	265,114	1,277,685	784,123	.....
1959										
Oct.	871,549	520,090	622,747	278,073	18,711	20,155	19,647	139,716	69,284	888,973
10 mo.	10,369,523	5,894,625	6,308,864	2,726,421	142,577	1,663,230	272,627	1,252,658	752,144	.....
Nov.	830,360	514,888	492,742	249,576	12,698	165,139	16,723	96,096	59,670	885,368
Dec.	1,106,796	583,571	649,200	270,276	14,651	294,129	20,595	92,139	50,733	845,575
Total	12,306,679	6,993,084	7,450,806	3,246,273	169,926	2,142,498	309,945	1,440,883	861,147	.....
1960										
Jan.	1,135,575	591,804	677,392	277,100	16,774	295,994	18,463	86,795	56,928	851,336
Feb.	1,107,721	571,143	678,927	279,190	16,430	284,738	17,848	76,332	49,876	855,324
Mar.	1,143,395	600,162	685,102	284,207	15,670	294,322	24,409	83,121	56,441	880,132
Apr.	1,051,357	580,590	609,234	258,994	13,980	232,895	21,737	118,886	68,605	834,495
May	1,052,798	588,770	613,745	257,180	13,126	207,094	20,414	136,455	75,090	781,596
June	1,049,638	601,597	622,236	273,148	15,010	183,049	19,810	144,773	79,770	719,564
July	803,306	450,580	478,269	202,347	10,694	120,784	16,226	120,652	67,375	754,789
Aug.	858,503	540,395	490,059	238,561	15,675	131,428	14,221	139,275	83,520	712,784
Sept.	900,497	527,227	554,788	245,887	14,616	125,658	13,460	135,327	71,234	695,325
Oct.	905,139	500,054	568,869	238,249	12,859	139,977	12,559	117,009	66,725	646,852
10 mo.	10,007,929	5,552,322	5,978,621	2,554,863	144,834	2,015,969	179,147	1,158,628	675,564	.....

*Source: U. S. Dept. of Interior Bureau of Mines. [1]Source: Bureau of Census. [2]For sale only. [3]All cast iron pipe is shipped for sale. [4]Gray iron total included nodular iron.

Late News

dustries. Much of its production will be replacement parts for U. S.-manufactured equipment.

SDCE OFFICERS: New president of the Society of Die Casting Engineers is John L. MacLaren, Aluminium Ltd. Sales Inc., Detroit. Mr. MacLaren was general chairman of the first National Die Casting Exposition & Congress, sponsored by the SDCE last November. Earle W. Rearwin, Prentice-Reed Div., Package Machinery Co., East Longmeadow, Mass., has been elected vice president. He formerly was a national director of the society.

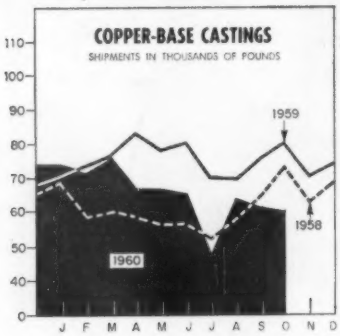
DOEHLER AWARD: Nominations have been opened for the 1961 Doehler Award, which recognizes outstanding contributions to the advancement of diecasting. The award is made annually by the American Die Casting Institute, national association of custom diecasters, and is based on technical achievement, advancements in plant operations, and other activities which enhance the reputation and acceptability of diecastings. Nominations should be submitted, with supporting material, before April 15, 1961, to the Award Committee, American Die Casting Institute, 366 Madison Ave., New York 17, N. Y.

STEEL CENTENNIAL: Centennial observance of the steel casting industry was launched Jan. 19 in Philadelphia by W. H. Moriarty, president, Steel Founders' Society of America, in an address to the Newcomen Society. Mr. Moriarty revealed that the SFSA annual meeting, to be held March 11-14 in Chicago, will be devoted to developments which can be expected in the steel casting industry in the future. In addition, the society is conducting a Centennial Product Development Contest with $10,000 in prizes.

PENN STATE CONFERENCE: The third biennial Penn State Foundry Conference will be held June 22-24 at Pennsylvania State University, University Park, Pa., and will include papers relating to the practical phases of gray and malleable iron, steel, nonferrous, and sand technology.

NICKEL: Free world consumption of nickel in 1960 set a new record of more than 250,000 tons, according to the International Nickel Co.

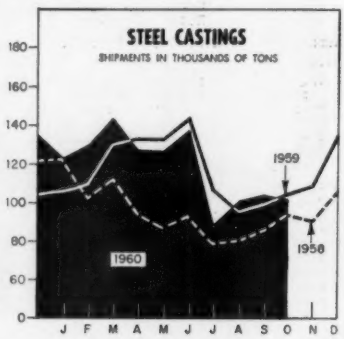
Foundry Statistics



COPPER-BASE CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments			Unfilled Orders[2]
	Total	Sand	Perm. Mold	
1958	762,484	697,360	31,854	.....
1959				
Oct.	77,385	67,186	5,120	28,092
10 mo.	731,697	643,970	43,330	.....
Nov.	68,255	59,094	4,840	29,147
Dec.	71,110	62,182	4,286	29,243
Total	871,032	765,246	52,456	.....
1960				
Jan.	73,971	65,742	3,915	26,053
Feb.	71,797	63,103	4,146	26,970
Mar.	75,908	66,517	4,346	27,470
Apr.	66,777	58,453	4,523	27,423
May	66,299	57,848	4,463	24,582
June	64,585	56,441	3,715	21,781
July	48,399	42,778	2,910	22,367
Aug.	63,765	56,344	3,669	21,915
Sept.	61,362	54,104	3,699	21,063
Oct.	59,853	52,709	3,556	22,008
10 mo.	652,716	574,039	39,042	.....



STEEL CASTINGS—SHIPMENTS

(Net tons[1])

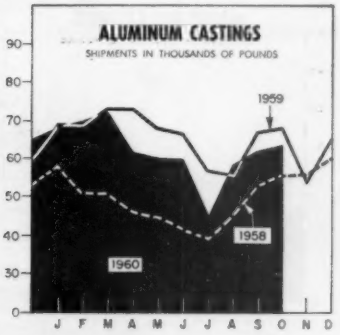
	All Castings			Carbon			Alloy			
	Total	For Sale	Railway Specialties	Total	For Sale	Railway Specialties	Total	For Sale	Railway Specialties	Unfilled Orders[2]
1958	1,121,000	856,986	149,644	801,846	606,240	136,251	319,154	250,746	13,393	.....
1959										
Oct.	105,570	84,850	11,819	80,127	63,901	10,973	25,443	20,108	841	268,874
10 mo.	1,170,079	922,504	180,352	866,575	677,408	166,202	303,504	245,096	14,150	.....
Nov.	109,460	86,026	11,764	77,320	59,294	10,799	32,240	26,732	965	301,858
Dec.	133,346	104,138	18,868	99,643	77,517	17,200	33,703	26,621	1,668	306,346
Total	1,412,885	1,112,668	210,984	1,043,538	814,219	194,201	369,447	297,608	16,783	.....
1960										
Jan.	122,565	94,052	22,016	93,197	70,815	20,891	29,368	23,237	1,125	314,237
Feb.	129,259	97,927	26,532	96,888	72,963	25,328	32,371	24,964	1,204	279,684
Mar.	143,708	109,688	27,801	104,742	78,755	26,365	38,966	30,933	1,436	277,982
Apr.	127,219	96,557	26,101	93,433	70,251	24,528	33,786	26,306	1,575	248,902
May	126,580	97,231	26,793	93,700	71,808	25,324	32,880	25,423	1,469	252,293
June	136,992	107,076	29,185	101,294	78,601	27,503	35,698	28,475	1,682	233,765
July	89,565	67,294	16,196	63,753	47,570	15,570	25,812	19,724	626	223,890
Aug.	101,709	77,146	16,113	73,338	55,099	15,207	28,371	22,047	906	213,611
Sept.	104,298	79,556	16,843	74,447	56,126	15,945	29,851	23,430	898	199,413
Oct.	102,664	79,622	17,455	70,452	55,787	16,443	32,212	23,835	1,042	186,311
10 mo.	1,184,559	906,149	225,065	865,244	657,975	213,102	319,315	248,374	11,963	.....

[1]Source: Bureau of the Census. [2]For sale only.

of Canada Ltd. The increase over 1959 was 15 per cent, although consumption in the U. S. and Canada showed almost no change. Europe accounted for 43.5 per cent of the total, the U. S. 43 per cent.

PERSONALS: Sherman B. Burke has been appointed vice president-sales, Hanna Furnace Corp., succeeding C. R. Welles, who has retired. Roger S. VanDerKar succeeds Mr. Burke as general sales manager, and Alden W. Gallup becomes Detroit district sales manager, Mr. VanDerKar's former position . . . Edgar W. Bliek has been appointed manager of the new Foundry & Metallurgy Div., Gleason Works, Rochester, N. Y. . . . J. J. Kroecker has been named sales manager, Permold Co., Medina, Ohio. L. E. DeGroat, vice president-sales for 20 years, continues as vice president and director . . . Herbert J. Cooper has been elected president and chief executive officer, Cooper Alloy Corp., Hillside, N. J., and its subsidiary, Vanton Pump & Equipment Corp. Div. He succeeds Harry A. Cooper, founder of the corporation, who becomes board chairman . . . New appointments at Carondelet Foundry Co., St. Louis, include John H. Culling, executive vice president; A. W. Gruer Jr., vice president-marketing; and Roy G. Heckenkamp, secretary-treasurer . . . Dan Pendergast, Commercial Building, Waltham, Mass., has been appointed New England sales representative for Foundry Equipment Co., Cleveland.

MISCELLANY: December orders for 2705 freight cars brought the 1960 total to 36,368 cars, compared with 56,489 in 1959 . . . Frederic B. Stevens Inc., Detroit, has acquired Clark-Cooper Co., Palmyra, N. J., manufacturer of flow metering pumps and related equipment . . . American Foundry & Fitting Co., with principal place of business to be Phoenix, Ariz., has filed articles of incorporation, listing Dominic Meaglia, 905 Chester Ave., San Marino, Calif., as president . . . Material Handling Institute's November index of material handling equipment orders was 98.96, against 99.89 in October and 124.16 a year ago . . . Modern Equipment Co., Port Washington, Wis., is acquiring the Newburg Machine Co., Newburg, Wis. . . . 1960 safety contest of the Institute of Scrap Iron & Steel Inc. developed an injury frequency rate of 37.6, best on record.



PRODUCTION WORKERS

Estimated Number

	Oct. 1960	Sept. 1960	Oct. 1959
Ferrous	183.1	185.7	194.2
Nonferrous	49.3	49.3	55.7

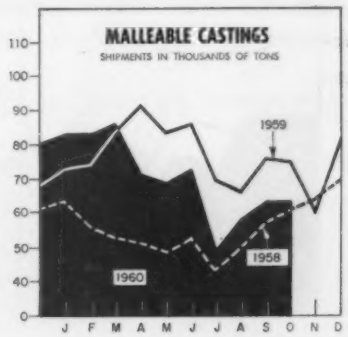
Average Weekly Earnings

Gray Iron	94.37	94.24	95.92
Malleable Iron	93.25	92.26	93.84
Steel	100.08	100.73	97.15
Nonferrous	102.36	101.96	103.58

Average Weekly Hours

Gray Iron	37.9	38.0	39.8
Malleable Iron	37.6	37.2	39.1
Steel	38.2	38.3	38.4
Nonferrous	40.3	40.3	41.6

Source: Bureau of Labor Statistics.



ALUMINUM CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments				Unfilled Orders[2]
	Total	Sand	Perm. Mold	Die	
1958	641,700	125,487	224,092	290,275	.....
1959					
Oct.	67,635	12,902	22,058	32,555	78,930
10 mo.	666,496	118,862	237,895	308,503	.....
Nov.	54,695	10,757	16,604	27,219	84,392
Dec.	65,208	12,368	20,356	32,379	86,947
Total	786,399	141,987	274,855	368,101	.....
1960					
Jan.	68,247	11,278	22,368	34,514	92,109
Feb.	71,699	11,800	23,614	36,177	83,914
Mar.	72,216	12,934	22,413	36,749	78,024
Apr.	61,797	12,339	19,950	29,400	75,243
May	60,330	10,682	21,507	28,055	75,977
June	60,068	11,280	20,953	27,722	74,699
July	45,694	8,765	15,804	20,973	76,434
Aug.	58,848	10,639	18,901	29,256	75,230
Sept.	62,116	10,514	22,031	29,527	75,144
Oct.	63,684	10,148	23,339	30,148	71,354
10 mo.	624,699	110,379	210,880	302,511	.....

[1]Source: Bureau of the Census. [2]For sale only.

MALLEABLE IRON CASTINGS

(Shipments of castings—net tons[1])

	Shipments		Standard		Pearlitic		Unfilled Orders[2]
	Total	For Sale	Total	For Sale	Total	For Sale	
1958	660,650	383,839	540,600	313,597	120,050	70,242	.....
1959							
Oct.	75,511	48,625	61,683	40,088	13,828	8,537	85,031
10 mo.	778,044	469,151	619,462	380,074	158,582	89,077	.....
Nov.	58,258	42,235	48,951	33,981	9,307	8,254	82,555
Dec.	80,060	45,917	61,455	35,891	18,605	10,026	93,874
Total	916,362	557,303	729,868	449,946	186,494	107,357	.....
1960							
Jan.	83,188	46,154	63,637	35,933	19,551	10,221	100,302
Feb.	83,118	46,850	64,131	37,391	18,987	9,459	98,272
Mar.	86,243	49,907	67,448	40,422	18,795	9,485	84,679
Apr.	71,271	39,059	56,136	32,066	15,135	6,993	79,237
May	68,942	37,618	53,108	30,126	15,834	7,492	73,240
June	72,593	43,105	55,956	34,526	16,637	8,579	63,920
July	49,860	28,575	37,187	22,477	12,673	6,098	74,329
Aug.	58,785	36,765	46,522	29,077	12,263	7,688	69,853
Sept.	63,048	36,114	48,635	28,623	14,413	7,491	69,033
Oct.	63,521	35,492	47,932	27,813	15,589	7,679	56,616
10 mo.	700,569	399,639	540,692	318,454	160,077	81,185	.....

Prices of Foundry Metals and Coke

(As of January 23, 1961)

FOUNDRY COKE

(Per net ton, f.o.b. ovens)

BEEHIVE

Connellsville	$18.00-$18.50

OVEN

Birmingham	$30.35
Buffalo	32.00
Detroit	32.00
Erie, Pa.	32.00
Indianapolis	31.25
Kearney, N. J.	31.25
Milwaukee	32.00
Neville Island (Pittsburgh)	30.75
New England, deld.	33.55
New Haven, Conn.	31.00
Painesville, O.	32.00
Philadelphia	31.00
St. Louis	33.00
St. Paul	31.25
Swedeland, Pa.	31.00
Terre Haute, Ind.	31.25

PIG IRON

(Per gross ton, f.o.b. furnace)

	No. 2 Foundry	Malleable
Birdsboro, Pa.	$68.50	$69.00
Birmingham	62.50	66.50
Boston, deld.	77.79	78.29
Buffalo	66.50	67.00
Chester, Pa.	Nom.	Nom.
Chicago	66.50	66.50
Cleveland	66.50	66.50
Duluth	66.50	66.50
Erie, Pa.	66.50	66.50
Fontana, Calif.	75.50	....
Geneva, Utah	66.50	....
Granite City, Ill.	68.40	68.90
Neville Island (Pittsburgh)	66.50	66.50
Swedeland, Pa.	68.50	69.00
Toledo, O.	66.50	66.50
Troy, N. Y.	68.50	69.00
Youngstown, O.	....	66.50

NONFERROUS INGOT

(Cents per pound, carlots)

BRASS AND BRONZE: Red brass, No. 115, 27.25; tin bronze, No. 225, 37.00; No. 245, 31.50; high-leaded tin bronze, No. 305, 31.75; No. 1 yellow, No. 405, 22.75; manganese bronze, No. 421, 26.50.

ALUMINUM: Primary alloy No. 13, 25.90; No. 43, 26.20; No. 195, 27.60; No. 214, 31.50; No. 356, 26.80. Secondary No. 12 alloy, 22.75. Deoxidizing grades: No. 1, 23.75; No. 4, 21.00.

MAGNESIUM ALLOY: AZ91A, 40.75; AZ63A, AZ92A, AZ91C, 40.75, f.o.b. Velasco, Tex.

COPPER: Electrolytic 29.00, delivered Connecticut valley.

ZINC: High grade, 12.85, delivered. Die casting alloy No. 3, 14.25; No. 2, 14.75, delivered.

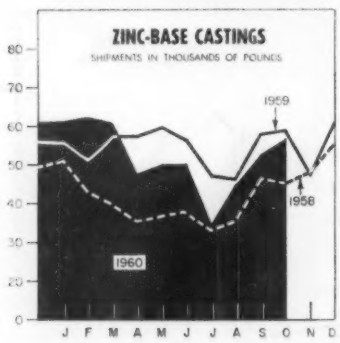
Iron and Steel Scrap

(Consumer prices per gross ton delivered, except as otherwise noted)

	No. 1 Heavy Melting Steel	No. 1 Cupola Cast	Heavy Breakable Cast	Machinery, Cast	Structurals, Plates	Malleable	Short Steel Rails
Birmingham	$33.00-34.00	$45.00-46.00	.....	.....	$36.00-37.00	.....	$45.00-46.00
Boston*	**23.00-24.00	**39.00-40.00	.....	**40.00-42.00	.....	.....	.....
Buffalo	27.00-28.00	**36.00-37.00	.....	**43.00-44.00	37.00-38.00	.....	46.00-47.00
Chicago	30.00-32.00	39.00-40.00	.....	44.00-45.00	33.00-34.00	43.00-44.00	45.00-47.00
Cincinnati*	**24.50-25.50	**35.00-36.00	**28.00-29.00	**46.00-47.00	.....	.....	**44.00-45.00
Cleveland	28.00-29.00	37.00-38.00	26.00-27.00	44.00-45.00	36.00-37.00	42.00-43.00	45.00-46.00
Detroit*	**20.00-21.00	**29.00-30.00	**22.00-25.00	.....	.....	.....	.....
Los Angeles	30.00	40.00-41.00	.....	.....	41.00	.....	.....
New York*	27.00-28.00	34.00-35.00	28.00-29.00	.....	31.00-32.00	.....	.....
Philadelphia	36.00	38.00	39.00	48.00-49.00	38.00-41.00	46.00	47.00-49.00
Pittsburgh	29.00-30.00	**31.00-32.00	.....	44.00-45.00	32.00-34.00	.....	47.00-49.00
St. Louis*	27.00	36.00	31.00	.....	.....	.....	43.00
San Francisco	32.00	46.00-48.00	28.00	45.00-46.00	40.00	.....	.....
Seattle	36.00	31.50	33.00	.....	.....	.....	.....

*Brokers' buying prices. **F.o.b. shipping point

Foundry Statistics



ZINC-BASE CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments—Total	Shipments—For Sale	Unfilled Orders[2]
1958	500,071	319,471	.....
1959			
Oct.	57,106	40,487	57,814
10 mo.	528,103	370,302	.....
Nov.	44,611	35,301	58,076
Dec.	58,496	37,406	65,723
Total	631,210	443,009	.....
1960			
Jan.	61,537	39,777	64,940
Feb.	62,925	42,089	66,945
Mar.	60,816	39,618	66,267
Apr.	47,553	31,423	56,312
May	50,844	33,551	56,654
June	50,809	34,264	51,960
July	35,117	25,186	52,392
Aug.	45,101	32,549	57,551
Sept.	52,514	34,451	57,480
Oct.	56,201	36,455	57,028
10 mo.	523,416	349,363	.....

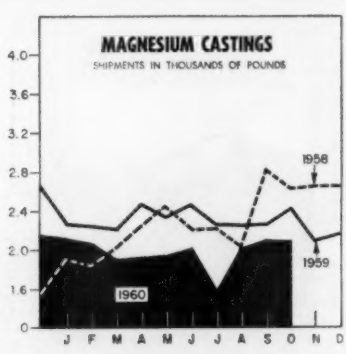
PIG IRON

PRODUCTION*—Net Tons

	Foundry	Malleable & Silvery	Low & Int. Low Phos. & Bessemer
1958	1,622,320	2,448,917	4,954,854
1959			
Nov.	148,660	180,927	216,063
Dec.	177,017	306,303	452,426
Totals[3]	1,889,445	2,810,359	3,471,683
1960			
Jan.	128,232	325,151	462,667
Feb.	148,238	338,866	471,755
Mar.	126,357	333,182	462,914
Apr.	134,509	258,452	395,875
May	135,825	290,057	356,931
June	105,717	247,991	309,942
July	117,218	166,084	290,384
Aug.	78,950	171,718	211,506
Sept.	93,260	202,895	152,880
Oct.	133,525	183,639	208,758
Nov.	122,500	231,203	206,062
11 mo.	1,324,381	2,751,960	3,536,255

CONSUMPTION*—Gross Tons

	Cupola	Air	Electric
1958	3,314,652	169,267	231,145
1959			
Aug.	288,547	15,937	4,923
8 mo.	2,690,743	150,837	264,297
Sept.	336,015	18,067	6,033
Oct.	351,679	20,011	5,749
Nov.	276,168	16,350	28,231
Dec.	334,524	18,613	47,045
Total	3,989,129	223,868	351,355
1960			
Jan.	328,242	18,634	45,936
Feb.	322,945	19,257	42,883
Mar.	317,520	21,042	43,959
Apr.	282,178	16,796	36,971
May	292,407	15,730	19,869
June	313,340	16,828	23,720
July	241,752	11,892	21,123
Aug.	273,722	14,697	27,919
8 mo.	2,372,106	134,876	262,380



MAGNESIUM CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments—Total	Shipments—For Sale	Unfilled Orders[2]
1958	28,776	25,024	.....
1959			
Oct.	2,426	1,880	3,501
10 mo.	23,086	19,770	.....
Nov.	2,012	1,618	3,281
Dec.	2,154	1,721	3,423
Total	27,253	23,109	.....
1960			
Jan.	2,135	1,588	3,209
Feb.	2,075	1,679	3,278
Mar.	1,903	1,524	3,208
Apr.	1,926	1,533	3,138
May	1,953	1,514	2,948
June	2,050	1,555	3,396
July	1,638	1,234	3,541
Aug.	2,025	1,530	3,364
Sept.	2,146	1,653	3,271
Oct.	2,038	1,519	3,274
10 mo.	19,889	15,329	.....

*Source: U. S. Dept. of Interior Bureau of Mines: **Source: American Iron & Steel Institute. [1] Source: Bureau of the Census. [2]For sale only. [3]Monthly figures do not add up to totals shown because of unreported monthly revisions.

DO IT YOURSELF

WHITEHEAD'S X-TRUDE-A-SEAL

Costs less than any packaged preformed strips

Stoller Chemical Co.'s X-TRUDER extrudes up to 45 ft. of seal strip per minute!

YOU'RE ON THE TARGET when you do it the X-Trude-A-Seal way! —

- Make your strips daily as you need them
- Re-extrude all leftovers the next day to desired sizes
- Sizes from ¼" to ¾" diameter

- Will not dry out or crack
- Economical — eliminates waste of material
- Applies faster than preformed extruded strips
- Reduces chipping, grinding, porous metal, leakers
- Eliminates uneven casting walls, excessive fins

Of course, Joint Seal is available for hand rolling, hand gun, or use with Stoller X-Truder

***FIND OUT HOW MUCH YOU CAN SAVE** — contact your distributor . . . or write direct*

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LYQUAGRIP
Ready-to-use core paste

DUO RESIN
Binder for baking with controlled oven temperatures

JOINT SEAL
Plastic compound for perfect sealing

LYQUAFACE
The liquid sand grain coating

DOB-IT
Ready-to-use core mudding compound

Circle 566 on Page 39

MR. FOUNDRYMAN:

Are you burning PROFITS in your furnaces?

Coreless electric induction furnaces cut operating costs and metal losses. Savings often pay for furnace in 1 year!

In today's highly competitive foundry business you can't afford out-dated methods and equipment. With rising labor and material costs, keeping pace with technological advances has become a do-or-die proposition. Progressive foundrymen the world over are learning that one of the quickest, surest ways of lowering production costs and improving quality is to convert to the coreless line frequency electric induction furnace pioneered by Brown Boveri. Many of them have paid for their original installation out of savings in the first year of operation! Proven designs available for every metal and in sizes to suit every application. Check the advantages listed below against your present equipment, then write us today for a full story on how Brown Boveri furnaces can put your foundry out ahead in the competitive race.

Advantages

1. Cooler, cleaner foundry conditions . . . no need for a separate melting building or for summer shutdowns due to excessive heat . . . better labor-management relations.

2. Virtually no fumes . . . no costly exhaust systems.

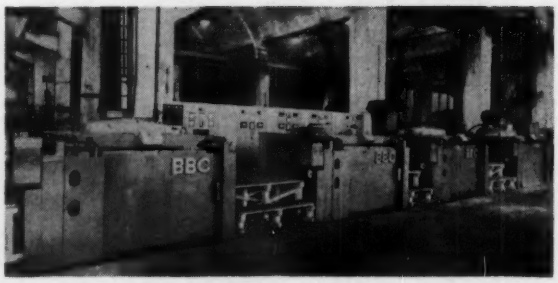
3. No channels to be clogged . . . no frequency converter . . . no electrode consumption.

4. Rapid starting and stopping . . . no need to hold furnaces at temperature between shifts or over weekends.

5. Easier ramming of crucible lining . . . long lining and crucible life . . . simple crucible replacement.

6. Highest quality castings . . . less casting scrap . . . lowest gas content in metal.

7. Simple, foolproof design . . . no need for skilled operators . . . entire installation handled from central station with single push-button control . . . automatic power factor and automatic safety monitoring . . . one man can supervise several furnaces.



Brown Boveri line frequency installation for melting aluminum; each furnace rated 1.3 tons, 360 kw and 380 v.

8. Lowest meltdown metal losses . . . rapid energy transfer results in shortest melting time . . . lowest consumption of flux.

9. Much greater use of scrap and borings for greater economy with minimum oxidation loss . . . cheaper materials produce product of high quality.

10. Hydraulic tilting mechanism . . . safety and precise control . . . hydraulic, heat-insulated furnace lid can be opened and closed in any furnace position.

11. Best alloying conditions. Perfect blending due to natural stirring action . . . most exact composition of alloys and full conservation of alloying elements . . . alloy additions made easily without segregation . . . quick changeover from one alloy to another.

12. Extremely accurate automatic temperature control and accurate reproduction of temperatures for uniform quality of successive charges . . . rapid, efficient superheating with maintenance of constant analysis . . . no possibility of local overheating.

13. Brown Boveri's unparalleled experience in furnace design, construction and operation . . . thousands of units of all types in successful operation . . . complete application department at your service.

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Brown Boveri Corp., Dept. F1, 19 Rector St., New York 6, N. Y. Agents in 27 U. S. cities. In Canada: Brown Boveri (Canada) Ltd., 1015 Beaver Hill Hall, Montreal 1, P.Q.

Brown Boveri offers a full range of line, medium and high frequency coreless and core-type induction furnaces; arc furnaces, resistance furnaces, radio frequency generators and complete accessories for a perfect mating of equipment to every operating condition and application. All backed by 70 years' experience in electrical and mechanical power equipment and one of the world's most extensive research and development programs in electrics and metallurgy assuring full unit responsibility and excellent coordination of every installation. Write for descriptive literature.

AFS Cancels Exposition at San Francisco Congress

The American Foundrymen's Society has cancelled the exposition originally scheduled to be held in connection with the 65th Castings Congress at San Francisco, May 8-12. A full technical program will be presented as planned.

This means that the next exhibit of foundry equipment and supplies will be at Detroit in May, 1962, when the 66th AFS Castings Congress and Exposition and the 29th International Foundry Congress will be held.

Technical program for this year's Congress at San Francisco's Civic Auditorium is expected to include more than 100 papers.

British To Hold Foundry Show

Next United Kingdom Foundry Exhibition will be held during May, 1963, in Birmingham, England. Inquiries as to availability of exhibiting space, etc., should be addressed to the Foundry Trades' Equipment & Supplies Association, 94/98, Petty France, London, S. W. 1, England.

SOFT SEAT—Despite its resemblance to a medieval torture press, this actually is a cast aluminum mold in which foam rubber automobile seat cushions are formed at a Goodyear Tire & Rubber Co. plant. Aluminum pins welded to the top half of the mold produce holes when foam rubber is poured into the mold, and give the seat cushions their desired resiliency. (Aluminum Co. of America photo)

Foundries See 4 to 5% Sales Gain

Heavier shipments of castings in 1961 forecast by 45 per cent of all foundries. If realized, expected gain would bring year's tonnage to nearly 1959 level. Most foundries plan capital spending this year

● FOUNDRYMEN look for an upturn in business during 1961, but their expectations are moderate—a rise of 4 to 5 per cent over 1960 castings shipments.

This forecast is based on opinions of a representative cross section of casting producers who participated in FOUNDRY's poll of the industry.

Only 15 per cent of all foundries expect their operations to slide further this year. Of the others, 45 per cent look for better business, and 40 per cent anticipate no change from last year. Net result is an indicated over-all improvement ranging from 3 to 4 per cent for gray iron and steel foundries to 5 to 6 per cent for nonferrous shops.

1960 Disappointing—Like other branches of the metalworking industry, foundries saw 1960 fall far short of their expectations. A year ago they predicted a 10 per cent rise in castings shipments over 1959. Instead, there was a 6 per cent drop to about 15 million tons.

During the last ten years, only two years recorded smaller shipments—1958 with 13 million tons and 1954 with 14½ million. The average for the last ten years was 16½ million.

Malleable foundries appear to be the most optimistic about 1961; only 6 per cent of them look for poorer business this year. By contrast, 23 per cent of the steel foundries see a decrease in production.

Small plants are somewhat more cheerful than the large producers. As shown in an accompanying table, 47 to 50 per cent of the foundries having fewer than 50 employees look for business improvement, against 41 to 42 per cent of the larger producers.

Rising Trend—Foundries apparently expect 1961 to open slowly, with improvement developing as the year progresses. In answer to the question, "How do you expect the second half of 1961 will compare with the first half?" 43 per cent of the foundries forecast an increase, 51 per cent no change, and 6 per cent a decrease. Under normal conditions the first half of a year usually is more active than the second six months.

Capital Spending — Nearly two-thirds of all foundries plan to make capital expenditures this year for plants and equipment, this study

Equipment Buying Plans

	Number of Foundries Planning to Buy the Equipment Indicated	Per Cent of Total Industry
Molding machines	1150	19%
Coremaking equipment	623	10
Sand preparation equipment	839	14
Core and mold ovens	167	3
Conveyors	544	9
Cranes	251	4
Hoists	292	5
Trucks and loaders	536	9
Melting furnaces	753	12
Heat treating equipment	398	7
Shakeout equipment	236	4
Blast cleaning equipment	465	8
Dust arrestors	300	5
Air compressors	358	6
X-ray and inspection equipment	116	2

What Foundries Expect of 1961 Shipments

	All Plants	Gray Iron	Malleable	Steel	Nonferrous
Percentages of foundries expecting increased production in 1961	45%	43%	47%	46%	48%
Percentages expecting decrease	15	15	6	23	14
Percentages expecting no change	40	42	47	31	38
Average increase expected	4-5%	3-4%	4-5%	3-4%	5-6%

Forecasts by Plant Size

	Per Cent Expecting Increase	Per Cent Expecting No Change	Per Cent Expecting Decrease
Foundries employing over 250	42%	38%	20%
Foundries employing 100-249	42	46	12
Foundries employing 50-99	41	44	15
Foundries employing 20-49	50	34	16
Foundries employing under 20	47	36	17

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for maximum efficiency... *Vancoram Graphidox*

The ideally balanced composition of Graphidox makes it a highly effective alloy for the supplementary deoxidation of steels. It is especially adaptable in foundry steels where control of grain boundary inclusions is essential.

Graphidox, a carefully proportioned alloy of silicon, titanium and calcium, is particularly effective in combination with aluminum where strong deoxidation is required. The dispersement of the non-metallics through efficient use of the calcium contributes to the increased yield strength of the steel.

In addition, Graphidox increases strength without material loss of ductility, increases fluidity, and improves machinability. VCA's technical staff is ready to help you. Just write or call our nearest District Office. Vanadium Corporation of America, 420 Lexington Avenue, New York 17, N. Y. • Chicago • Cleveland • Detroit • Pittsburgh

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also showed. Investments in plants will be largely for additions, with few new foundries in prospect.

Capital Expenditure Plans

(Percentages of foundries planning to make plant additions and to replace equipment)

Plant Employment	Plant Additions	Equipment Buying
Over 250	19%	77%
100-249	10	70
50-99	14	71
20-49	11	50
Under 20	12	32

Approximately 60 per cent of all foundries plan to buy equipment, but the percentage varies by size of foundry. Buying intentions are indicated by 50 per cent or fewer of the smaller companies, but 70 per cent or more of the large firms expect to make purchases.

An accompanying table, listing principal types of equipment foundries expect to buy this year, shows that heaviest demand will be for these items: Molding machines, sand preparation equipment, melting furnaces, coremaking equipment, conveyors, trucks and loaders, and blast cleaning machines.

Grinding Wheel Institute Elects Officers for 1961

L. A. Patt

The Grinding Wheel Institute, an association of manufacturers of grinding wheels and related products, will be headed this year by L. A. Patt, chairman of the board; W. G. Pinkstone, president, and C. F. Leitten, vice president.

Mr. Patt is vice president and general manager, Bonded Abrasives Div., the Carborundum Co. Mr. Pinkstone is vice president, A. P. de Sanno & Son Inc., and Mr. Leitten is president, Electro Refractories & Abrasives Corp.

C. F. Leitten

W. G. Pinkstone

The following new directors also were elected at the institute's fall meeting: R. C. Franklin, Macklin Co.; C. R. Anderson, Robertson Mfg. Co.; M. W. Gormly, Cincinnati Milling Machine Co., and H. G. Jones, Mid-West Abrasive Co.

DISPLAY: Zenith Foundry Co., West Allis, Wis., in co-operation with the Milwaukee Solvay Coke Co., furnished this display of gray iron castings and foundry operations. It was shown in a street window of the latter's office

AFS Announces Schedule of Training Courses for 1961

The American Foundrymen's Society Training and Research Institute has scheduled its fifth series of supervisory-training courses for the foundry industry.

This program was first presented in 1957, and since that time 51 short intensive courses have been given to over 1500 foundrymen. To date over 600 companies from the United States, Canada, Mexico, and overseas countries have participated in the courses.

Course subjects have included practically all topics of major interest in the industry, with several new courses being added each year. The courses have varied in length from two to five days and have been presented in leading foundry centers.

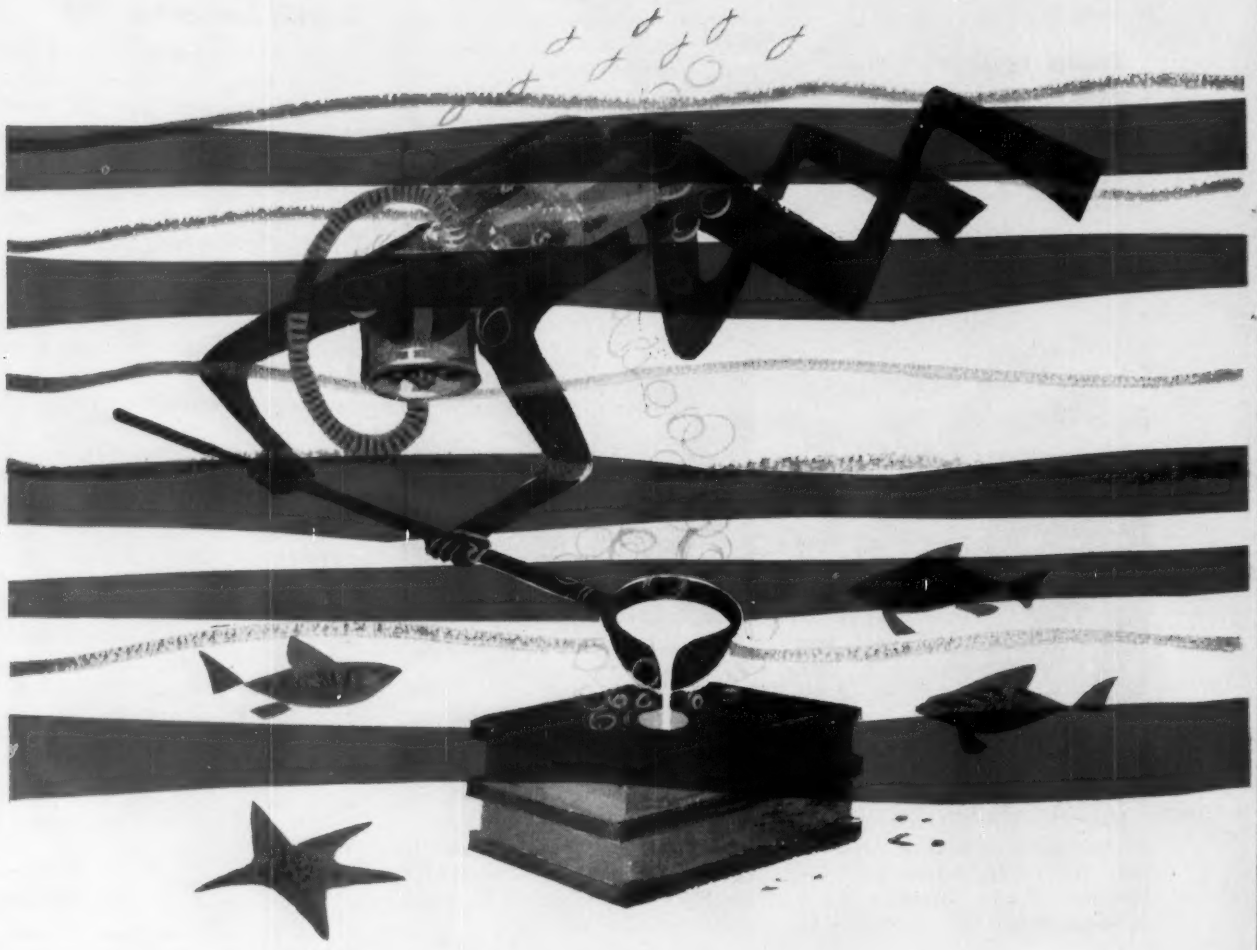
As a service to AFS chapters, local regional courses have been presented when requested. Ten such programs have been co-sponsored by local chapters during the last four years. 1961 scheduled courses are listed below:

No.	Course	Date	Place
*1	Gating and Risering	Jan. 9-10	Houston
2	Cupola Melting of Iron	Jan. 30-Feb. 3	Chicago
*3	Sand Control and Technology	Feb. 13-15	Chattanooga
4	Production of Ductile Iron	Feb. 22-24	Chicago
*5	Preventive Maintenance	March 2-3	Hamilton, Ont.
*6	Shell Molds and Cores	March 8-10	Birmingham
7	Economical Purchasing of Foundry Materials	March 27-29	Chicago
8	Core Practices	May 22-26	Chicago
9	Sand Testing	June 26-30	Detroit
10	Gating and Risering	July 17-19	Chicago
11	Defects—Causes and Remedies	Sept. 13-15	Chicago
12	Metallurgy of Gray Iron	Oct. 2-4	Chicago
13	Sand Control and Technology	Oct. 18-20	Detroit
14	Cleaning Room Operation (New Course)	Nov. 1-3	Chicago
15	Production Scheduling and Control	Dec. 4-6	Chicago

*Co-sponsored Chapter Regional Course

Additional information is obtainable from R. E. Betterley, Training Supervisor, AFS-Training and Research Institute, Golf and Wolf Roads, Des Plaines, Ill. Telephone: VAnderbilt 4-0181.

IMC A REPORT TO FOUNDRIES FROM TOM BARLOW



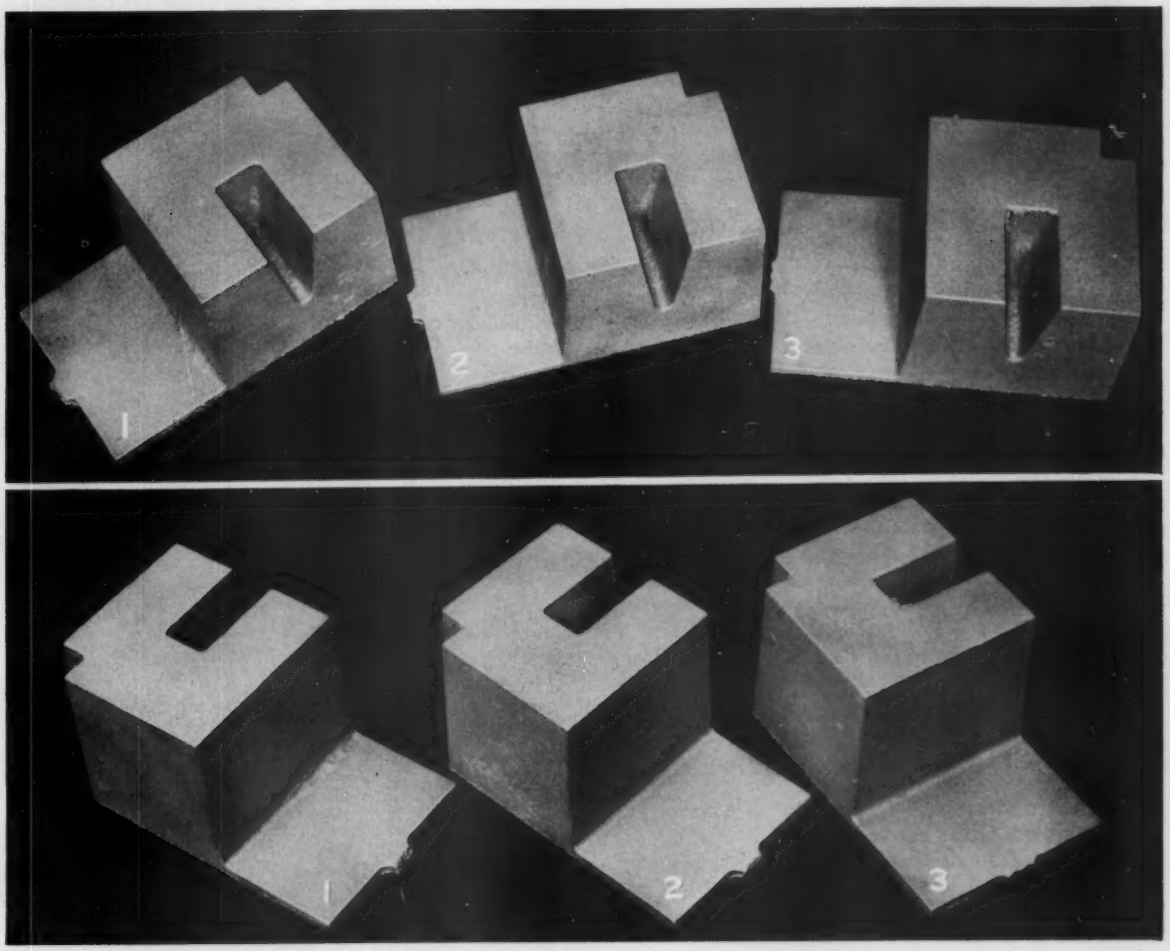
The casting that can't be made!

Years ago, a very popular poem (in the foundry industry) described the saga of the design engineer who made change after change until he developed the ultimate in design. His success was summed up in the last line "... it can't even be cast." The foundryman is often faced by what seems to be the impossible — or at least the improbable. Maybe we have stumbled on one possible answer to this dilemma. To tell the story properly, we should mention three related episodes in the life of your roving reporter.

A number of years ago, Bert Parker showed me a casting he adopted to test sand additives. We borrowed the idea and have been using it in our research ever since. It has been the acid test for our additives such as Plasti-Bond, Triplact and Z-Flo. (Incidentally, in this casting, they all do a good job.) It really separates the sheep from the goats. (See castings marked #1 on photo.)

About six months ago in a meeting of the committee studying scrap castings, someone asked whether a single casting could have all possible defects at the same time. My answer was that Bert's design came as close as any — or closer.

While lounging (at least the room was called a "lounge") after a Cleveland AFS meeting, I got a chance to pick the brains of Ernie Thomas on the same subject. He told me that if you use *too much clay and not enough water*, you can make anything . . . and make it



good. This conversation rang a few bells of earlier conversations of special (and, let's say, "screwy") mixes that were reported to work. To make a long story short, we decided to try it. Obviously, we would start with the casting that we already knew couldn't be made.

The results are in the photograph. These may or may not impress you. If they don't, I can only suggest you try to make this casting in your existing sand and see what happens.

We used three mixes, all based on 50% Juniata and 50% Michigan City sand. The first was made with 7% sea coal; the second was made with 3% sea coal and 0.5% Plasti-Bond and the third was made with 1% Plasti-Bond. Nos. 2 and 3 were the best. No. 2 had a rat-tail and fewer veins. No. 3 had somewhat more veining and no rat-tail.

Aside from the castings being remarkably close to perfect, we found some peculiar properties. Strengths were high — as expected. They ranged from 17 to 24 psi. But the deformations were also good — and this was unexpected. They were on the order of .016 to .017. Permeability was unusually low—from 10 to 11 — and yet there was *no sign* of a blow-hole or shrink-blow.

The formula was based on using 15% Black Hills Bentonite and only 3% H_2O. This is a long way under temper and would probably be impossible unless the mulling cycle is carefully followed. Please don't try this unless you follow the cycle exactly. You start with sand plus additive (Plasti-Bond preferred, of coarse), plus 5% Black Hills, mull dry and then bring to proper temper. This will be about 2.8% to 3.2% moisture. Then add 10% more Black Hills and mull *without any more water*. The sand will be dry and apparently hard to mold, but maybe it will make a casting like you never saw before. This sand can be reused in the normal fashion provided you keep the moisture under control at this very low level. No one (except Ernie) has a lot of experience along this line, but we have carried it as far as we can in the laboratory. If you want to experiment in the foundry, we'll be glad to help. Have fun!!!

P.S. Since this process requires three times as much bentonite as usual, please be sure it is Black Hills Bentonite. After All — !!!!

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Circle 569 on Page 39

Cast Segments Form Shaft Lining

By GEORGE E. TOLES

● THE FIRST cast iron shaft tubbing, or lining, was manufactured in the western hemisphere when International Minerals & Chemicals Corp. decided to install one in the No. 1 Yarbo shaft of its potash mine near Esterhazy, Sask., Canada.

The tubbing was designed in Germany. Formulas for the design have been developed by European mining engineers during the last 70 years, and more than 300 mine shafts have been lined this way.

John Bertram & Sons Co. Ltd., Dundas, Ont., was awarded the contract to supply the 836 cast segments, which weighed approximately 3400 tons.

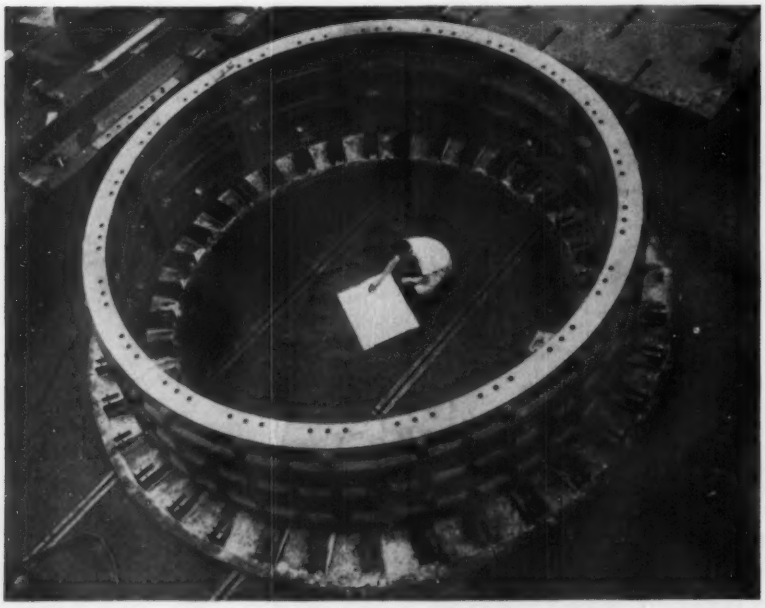
The castings were inspected carefully, and 7 per cent of the castings were radiographed completely by Standard Inspection Services, Hamilton, Ont. Other test segments were subjected to destructive tests to produce samples for examination of grain structure. Quality control of the metal included the making of standard ASTM tension and transverse tests on samples taken from each heat.

An order of this size presented many problems to the manufacturer, whose plant is designed for job production of large hoists and machine tools. It involved planning and laying out a production line for the efficient handling of the 4-ton segments.

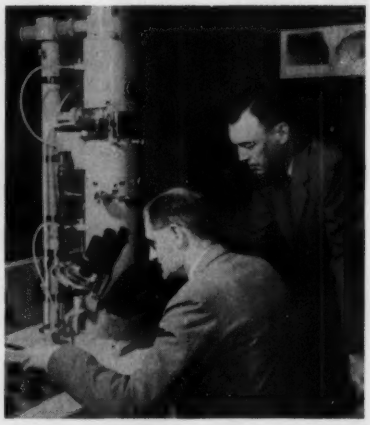
The foundry cast ten segments a day, six days a week, of ASTM Class No. 35 gray iron.

In the machine shop the flanges of the segments were machined to close tolerances, and six bolt holes were drilled in each of the four flanges. Eleven segments were assembled in a test ring set up on the floor to assure a correct fit, and each group of segments forming a complete ring was shipped as one lot.

Assembly of the lining required 10,000 steel bolts and 20,000 steel washers, machined on all contact faces. The precision machining and interchangeability of segments are essential for efficient assembling of the tubbing in the shaft. Each of the 16 rings installed has gone together smoothly and rapidly.



Test assembly of one ring at plant of John Bertram & Sons Ltd.



BRITISH TECHNIQUE is applied to the EM6 electron microscope of Associated Electrical Industries Ltd., which has obtained Picker X-Ray Corp., White Plains, N. Y., as the United States agent for its nuclear laboratory products. Bertram Richardson, (left), AEI engineer, and John Reynolds, Picker technical director, look into the microscope which produces clear pictures of objects magnified more than a million times. AEI is the United Kingdom's major electrical and electronic firm.

FEF Plans College-Industry Conference for April 19-20

Foundry Educational Foundation will hold its 14th annual College-Industry Conference at Hotel Statler-Hilton, Cleveland, on April 19-20.

Main theme of the first day's meeting will be "The FEF Graduate in Industry." Several speakers, all FEF scholarship holders during their student days, will speak on the FEF graduate in metallurgy, in quality control, in plant engineering, in research and development, in design and application, in technical sales and service, in supervision and management, and in education.

Speakers on the second day will discuss summer employment of FEF undergraduates in foundries, including viewpoints from both companies and students. Luncheon address, which concludes the conference, will be "Blueprint for the FEF Future" given by Dr. David H. Morgan, Dow Chemical Co., the FEF president-elect.

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Circle 570 on Page 39

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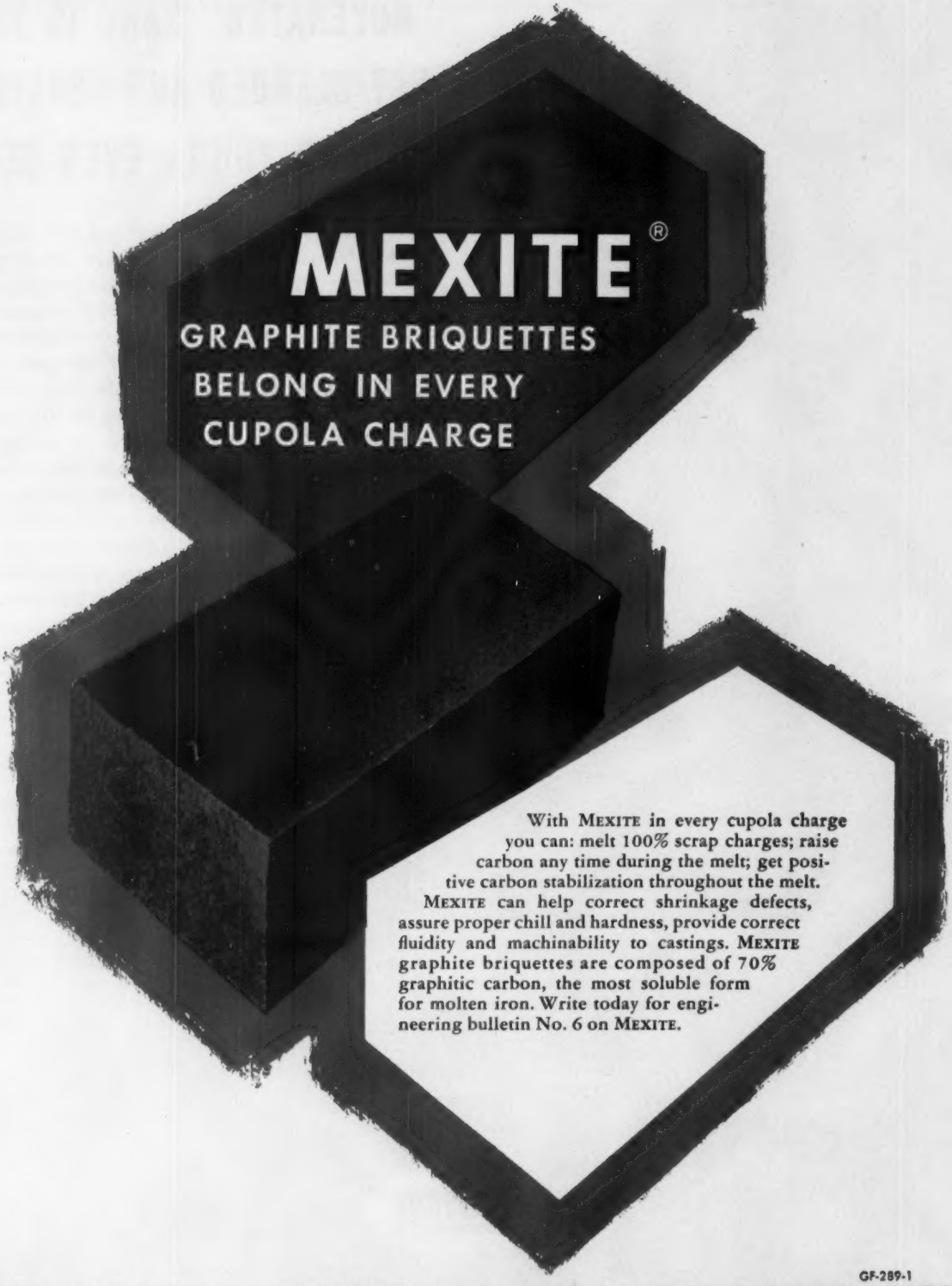

With MEXITE in every cupola charge you can: melt 100% scrap charges; raise carbon any time during the melt; get positive carbon stabilization throughout the melt. MEXITE can help correct shrinkage defects, assure proper chill and hardness, provide correct fluidity and machinability to castings. MEXITE graphite briquettes are composed of 70% graphitic carbon, the most soluble form for molten iron. Write today for engineering bulletin No. 6 on MEXITE.

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Calendar of MEETINGS

Feb. 9-10—Wisconsin Regional Foundry Conference, Schroeder Hotel, Milwaukee.

Feb. 16-17—Southeastern Regional Foundry Conference, Read House, Chattanooga, Tenn.

Feb. 22-24—Alloy Casting Institute, Midwinter Management Meeting, Boca Raton, Fla.

Feb. 22-24—Material Handling Institute, Pacific Coast Show, Cow Palace, San Francisco.

Feb. 26-Mar. 2—American Institute of Mining, Metallurgical, and Petroleum Engineers, annual meeting, St. Louis.

March 1-2—Malleable Founders' Society, Technical & Operating Conference, Pick-Carter Hotel, Cleveland.

March 11-14—Steel Founders' Society of America, annual meeting, Drake Hotel, Chicago.

March 20-24—American Society for Metals, Western Metal Congress & Exposition, Pan-Pacific Auditorium, Los Angeles.

April 10-12—American Institute of Mining, Metallurgical & Petroleum Engineers, Open Hearth Steel Conference, Sheraton Hotel, Philadelphia.

April 17-21—American Welding Society, Annual Meeting & Welding Show, Commodore Hotel and Coliseum, New York.

April 18-20—Foundry Educational Foundation, annual college-industry conference, Hotel Statler-Hilton, Cleveland.

May 8-12—American Foundrymen's Society, Castings Congress, San Francisco.

May 15-17—British Investment Casters' Technical Association, annual conference, London, England.

May 22-25—American Society of Mechanical Engineers, Design Engineering Show, Cobo Hall, Detroit.

June 5-7—American Society for Quality Control, annual convention and exhibit, Sheraton Hotel, Philadelphia.

June 8-9—Malleable Founders' Society, annual meeting, Broadmoor, Colorado Springs, Colo.

June 18-20—Alloy Casting Institute, annual meeting, Homestead, Hot Springs, Va.

June 22-24—Penn State Regional Foundry Conference, Pennsylvania State University, University Park, Pa.

June 25-30—American Society for Testing Materials, annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

Sept. 11-13—European Investment Casting Congress, Italy.

Sept. 18-20—Non-Ferrous Founders' Society, annual meeting, Shawnee Inn, Shawnee-on-Delaware, Pa.

Sept. 21—Cast Bronze Bearing Institute, annual meeting, Shawnee Inn, Shawnee-on-Delaware, Pa.

Sept. 24-26—Steel Founders' Society of America, fall meeting, Homestead, Hot Springs, Va.

Sept. 27-28—American Die Casting Institute, annual meeting, Edgewater Beach Hotel, Chicago.

Oct. 7-10—Conveyor Equipment Manufacturers Association, annual meeting, Ponte Vedra Inn, Ponte Vedra Beach, Fla.

Oct. 18-20—Gray Iron Founders' Society, annual meeting, Royal York Hotel, Toronto, Ont.

Oct. 19-21—Foundry Equipment Manufacturers Association, annual meeting, Greenbrier, White Sulphur Springs, W. Va.

Oct. 23-27—American Society for Metals, National Metal Congress & Exposition, Cobo Hall, Detroit.

Nov. 13-15—Steel Founders' Society of America, Technical & Operating Conference, Hotel Pick-Carter, Cleveland.

Nov. 15-17—National Foundry Association, annual meeting, Savoy-Hilton Hotel, New York.

Dec. 6-8—American Institute of Mining, Metallurgical, & Petroleum Engineers, Electric Furnace Conference, Penn-Sheraton Hotel, Pittsburgh.

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Shepard Niles Vapor-Proof Hoist

LOWER THE COST OF LIFTING YOUR LOADS

Each Shepard Niles **JOB-MATED** Hoist is supplied with the combination of components best suited to meet your exact on-the-job conditions. This care in our plant means reduced handling, production, and storage costs in yours . . . through increased efficiency, minimum maintenance costs and extra years of service with QUALITY equipment.

You can choose **JOB-MATED** Hoists in capacities from ¼-ton to 30 tons . . . with motor-driven or push-type trolleys . . . single or multiple speed controls (multiple speed provides from 5 to 17 control steps) . . . pushbutton, pendant rope, or lever controllers . . . floor or cab-operation . . . vapor-proof or explosion-proof construction.

Each **JOB-MATED** Hoist is tested under full load before shipment, and is guaranteed to perform as rated without overheating of motors, controllers, and brakes. You'll find it will pay to look into Shepard Niles **JOB-MATED** QUALITY Hoists for your load-lifting and moving operations. Write for descriptive bulletin and request a representative to call.

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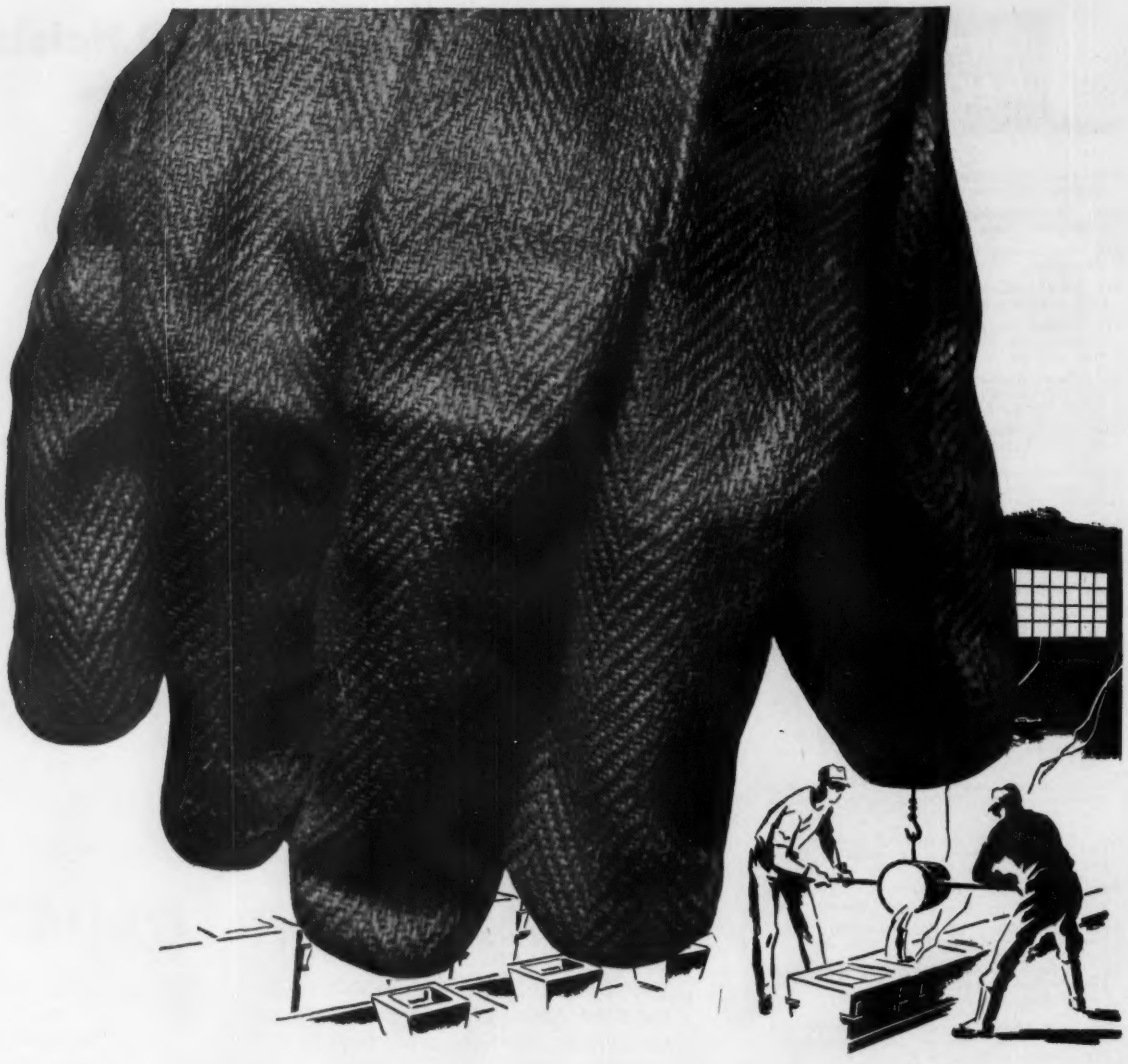


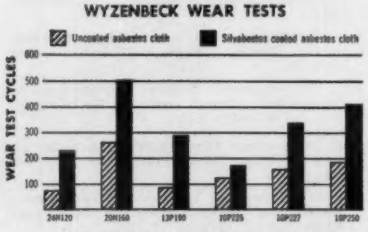
Silvabestos® doubles foundry glove life

Wear tests prove R/M Silvabestos® cloth outwears uncoated asbestos cloths by as much as 249%. No wonder it's a favorite for tough, abrasion-resistant foundry gloves and safety garments.

Stop paying for frequent glove replacement. Start enjoying the extra flexibility, light weight, and heat resistance of gloves made of genuine R/M Silvabestos. A new high in protection.

R/M makes the cloth—safety garment manufacturers fabricate it into gloves and a full line of safety clothing. Ask your regular supplier for Silvabestos cloth in all your foundry protective garments . . . or write us for names of fabricators.

Superior wear of Silvabestos (black bars) vs. uncoated asbestos cloths of the same grades is shown in test findings at right. *Note:* Silvabestos should not be used in contact with open flame.



(the above numbers are R/M style numbers)

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Circle 573 on Page 39

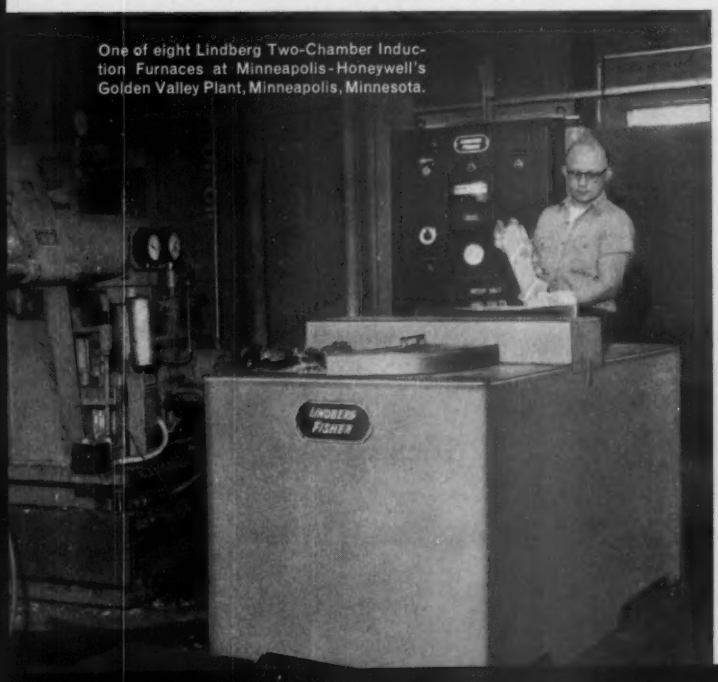
ART GEORGE has a good word to say for Lindberg Melting Furnace performance

QUOTE

Mr. Art George, Senior Production Engineer, Golden Valley Plant, Minneapolis-Honeywell Regulator Company, Minneapolis, Minn.

"Our installation of eight* Lindberg-Fisher Two-Chamber Induction Melting and Holding Furnaces has given remarkable service for more than four years. In this period, with the help of a well executed Honeywell maintenance program, the installation has been unusually trouble-free. Only one of the eight furnaces has required relining over this long period. Handling more than 1,000,000 pounds of aluminum and zinc annually, the installation has unfailingly provided the consistently high quality of metal our precision instruments require."

**Altogether, 44 Lindberg Furnaces are in operation in various Honeywell plants.*



One of eight Lindberg Two-Chamber Induction Furnaces at Minneapolis-Honeywell's Golden Valley Plant, Minneapolis, Minnesota.

These eight Lindberg-Fisher Induction Furnaces melt and hold aluminum and zinc for die casting gas valve housings and other component parts. They are located at the die casting machines where ingot and scrap can be melted and held at the desired casting temperature in one convenient unit. Magnetic fluxing and stirring insures uniform temperatures and consistently clean metal.

In any production process where aluminum needs heat there is Lindberg equipment to apply it most economically and efficiently. Furnaces for melting and holding, casting stations, re-melting or heat treating are available in all capacities, electric or fuel fired. Get in touch with your Lindberg Field Engineer (see your classified phone book) or write us direct. Lindberg-Fisher Division, Lindberg Engineering Company, 2453 West Hubbard St., Chicago 12, Illinois.

Los Angeles plant: 11937 S. Regentview Avenue, Downey, California. In Canada: Birlefco-Lindberg Ltd., 15 Pelham Ave., Toronto 9, Ont. Also, Lindberg plants in Argentina, Australia, England, France, Italy, Japan, South Africa, Spain, Switzerland and West Germany.

Circle 574 on Page 39

LINDBERG
heat for industry

When a large Steel Foundry installed an overhead Cleveland Tramrail system to serve its pouring floor two significant things happened: (a) production increased greatly, (b) costs went down.

Factors contributing to these results were:

1. Enabled use of larger pouring ladles
2. Provided efficient working routine
3. Reduced delivery time of metal to molds
4. Decreased heat loss in metal
5. Eliminated much hand lifting, lugging and hard labor
6. Minimized worker fatigue
7. Promoted safety

Because of the phenomenal success with the pouring floor installation, Cleveland Tramrail was installed in other departments with equally remarkable results. In nearly every instance the equipment paid for itself within the first six months of operation.

GET THIS BOOK!

BOOKLET No. 2008. Packed with valuable information. Profusely illustrated. Write for free copy.

CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO.
3804 East 286th St. Wickliffe, Ohio

CLEVELAND TRAMRAIL
OVERHEAD MATERIALS HANDLING EQUIPMENT

Circle 575 on Page 39

WHEN IT COMES TO CHAPLETS AND CHILLS . . .

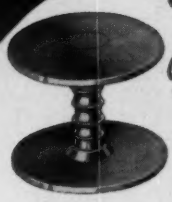
FANNER HAS THE GREATEST*

* GREATEST SERVICE — Through a staff of experienced sales engineers and factory "know-how".

* GREATEST LINE OF PRODUCTS — The most complete range of highest quality chaplets and chills in the world.

* GREATEST DELIVERY — From an inventory of over 100,000,000 pieces produced through specialized facilities and the latest manufacturing methods.

WHY NOT GET THE "GREATEST" — WHEN IT COSTS NO MORE?



* FANNER *Groovestem* CHAPLETS are typical of FANNER SUPERIORITY OF DESIGN

(1) Featheredge Fusion Rings, (2) Complete Contact Radius Grooves, and, (3) Countersunk Shoulders on Stem provide:

MAXIMUM FUSION
ASSURED CORE SUPPORT
FREEDOM FROM LEAKERS
ACCURATE WALL THICKNESS

Precision tolerances too — ± .002 on most sizes. Made in a wide variety of types.

the FANNER MANUFACTURING CO.

Designers and Manufacturers of Fine Fanner Chaplets and Chills

Brookside Park
Cleveland, Ohio
Phone: CLEVELAND — SH. 1-6000

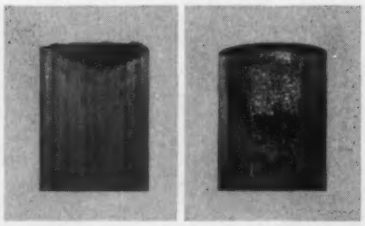
Circle 376 on Page 29

Riser metal stays molten twice as long with J-M RIS-A-SLEEV

THE INSULATED RISER SLEEVE FOR NON-FERROUS METALS THAT ASSURES UNIFORM FEEDBACK TO EVERY PART OF THE MOLD

Now you can get perfect finished castings every time with Johns-Manville Ris-A-Sleev®, the new riser sleeve that cuts heat transfer in half. The heat is contained *in the sleeve,* keeping the metal molten twice as long as the most effective competitive product. This allows more time to complete feed-back.

Ris-A-Sleev's more effective insulation serves to reduce the size of the risers, thereby giving you closer control of solidification. What's more, smaller risers mean a big reduction in cut-off waste. The following photographs graphically demonstrate Ris-A-Sleev's superiority over a leading competitive product.



Under identical test conditions, brass pourings were made with a Ris-A-Sleev and an ordinary riser sleeve. Note how riser metal from the mold equipped with a Ris-A-Sleev (left) has solidified uniformly with very little concavity, indicating uniform feedback to mold. Then note how the riser from mold using competitive sleeve (right) has cooled quickly around circumference, while center of riser stayed molten, resulting in pronounced concavity and uneven feedback.

Try Johns-Manville Ris-A-Sleev and discover the economic way to improve bronze, brass and aluminum castings. They are available in a complete range of sizes. For full information write Johns-Manville, Box 14, New York 16, N. Y. Ask for brochure IN-247A.

JOHNS-MANVILLE

AN INSULATION FOR EVERY COMMERCIAL AND INDUSTRIAL USE

JOHNS-MANVILLE JM PRODUCTS

Circle 577 on Page 39

FOUNDRY

Reader Information Service

Advertising content is classified by subject and listed by page number for your convenience when studying specific foundry applications. For further information on subjects advertised, refer to advertisement on the page indicated and circle Item Number on Reader Service Card —Page 39.

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FOUNDRY

Reader Information Service

Just mail one of these cards—for more information on anything advertised in this issue . . . for further data on products described in the Equipment and Supplies section (Page 93) . . . to get copies of publications listed in the Literature for Foundrymen section (Page 131) . . . to request extra copies of editorial articles.

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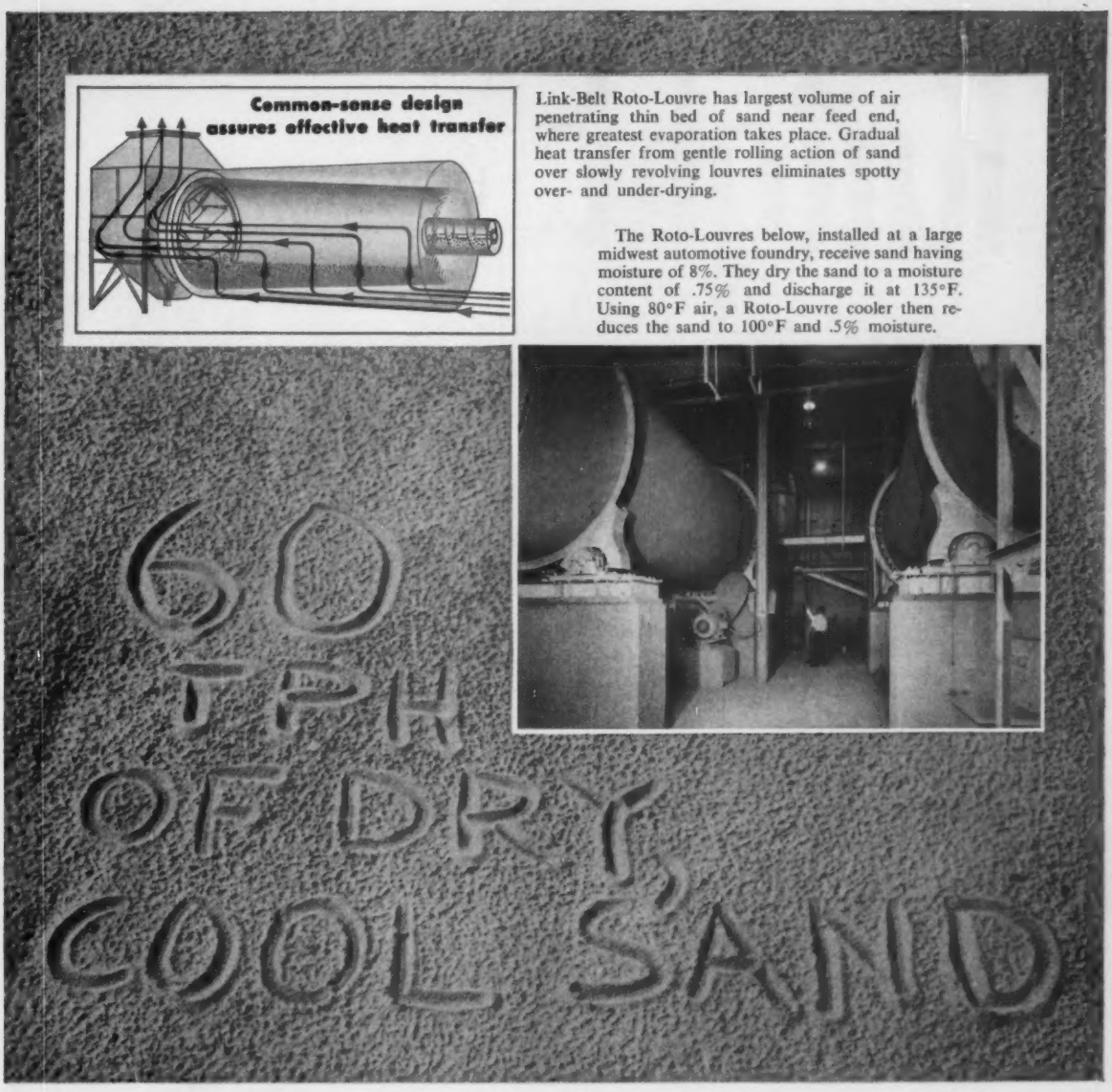

Link-Belt Roto-Louvre has largest volume of air penetrating thin bed of sand near feed end, where greatest evaporation takes place. Gradual heat transfer from gentle rolling action of sand over slowly revolving louvres eliminates spotty over- and under-drying.

The Roto-Louvres below, installed at a large midwest automotive foundry, receive sand having moisture of 8%. They dry the sand to a moisture content of .75% and discharge it at 135°F. Using 80°F air, a Roto-Louvre cooler then reduces the sand to 100°F and .5% moisture.

. . . with LINK-BELT Roto-Louvre dryers and cooler

Two Link-Belt Roto-Louvre dryers and one cooler have eliminated a costly sand shortage problem for a large midwest automotive foundry.

Because their old system was inadequate and antiquated, additional dried sand had to be purchased at premium costs. Now, with the high-capacity Link-Belt dryers and cooler, production needs are easily met. What's more, the new system is designed to handle anticipated future needs.

This is just one of many foundries that have found Link-Belt Roto-Louvre to be the low-cost answer to needed capacity. Roto-Louvre efficiency results from an exclusive design that assures positive temperature control . . . and uniform air contact with *every* grain of sand.

Roto-Louvres can be used as dryers, dryers-coolers or coolers. For details, contact your nearest Link-Belt office. Or write for Foundry Equipment Book 2423 and Roto-Louvre Book 2511.

LINK-BELT

HANDLING AND SAND PREPARATION MACHINERY

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Warehouses and District Sales Offices in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs. Representatives Throughout the World. 15,200

Knight LETTER

FOURTH OF A SERIES

To: Foundry Management

Subject: Audit of Operations

Why should foundries consider a periodic audit of operations by Knight Engineers?

Because – even the best of operations need occasional review to make certain the organization and administration have kept pace with the growth and changes of the business . . . that cost and estimating information is accurate and realistic.

. . . that methods and facilities permit highest productivity for men and machines.

. . . that scrap and rework are as low as they should be.

. . . that melting techniques and facilities permit the use of lowest cost metallics and result in low cost, uniformly high quality metal.

. . . that the incentive system is truly an incentive to produce a full day's work for a full day's pay and not a floor on wages and ceiling on production.

. . . that immediate and long range plans are being followed to maintain a modern, low-cost operation with an adequate return on investment.

Knight Engineers bring to bear on your particular foundry problem the experience gained from professional analyses of hundreds of foundries – in the United States, Canada, Europe and South America.

If you are considering an operations audit, call any Knight office for further details on how you can put Knight foundry engineering experience to work for you.

Lester B. Knight

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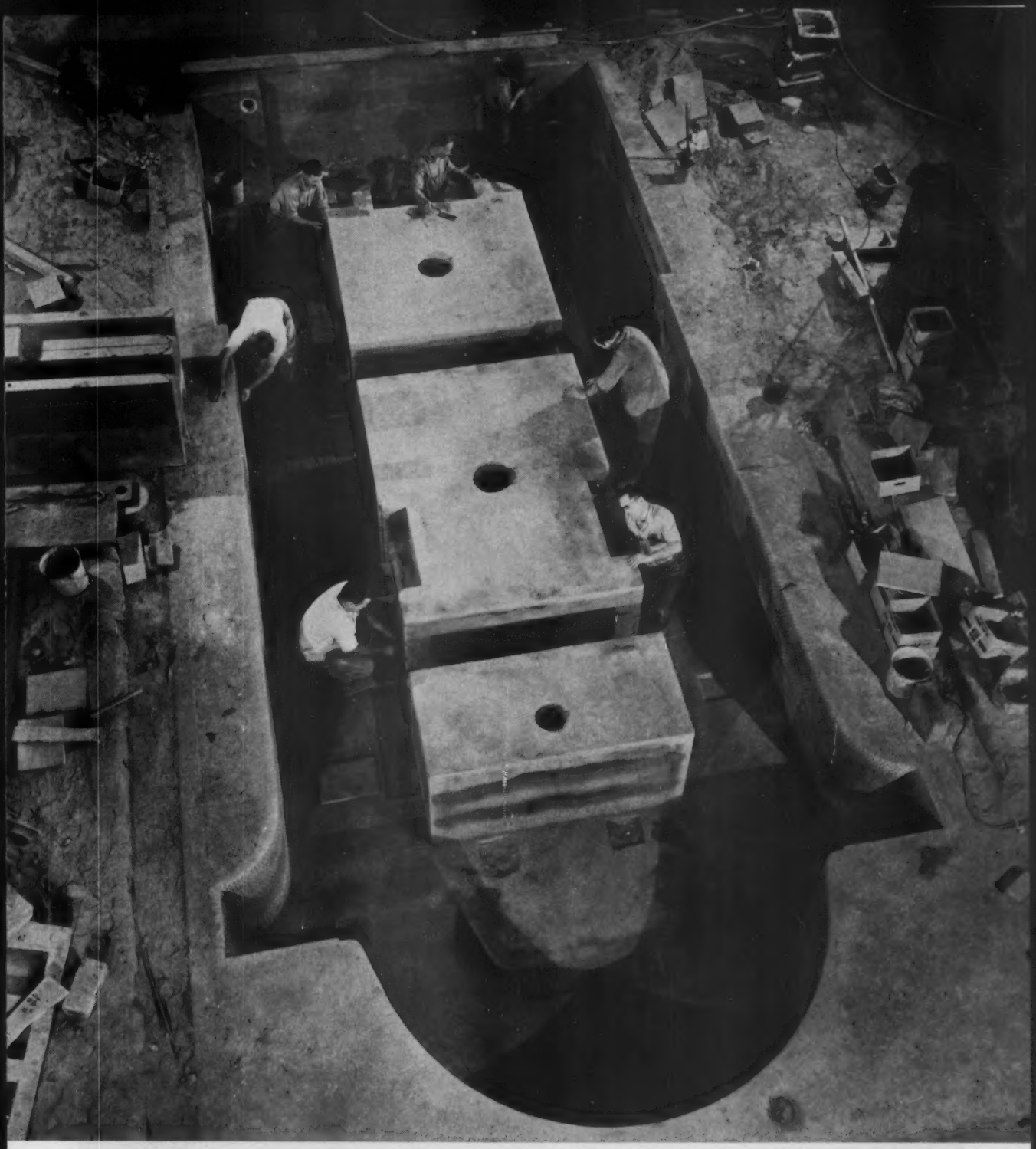
Knight Engineering Establishment (Vaduz), Zurich Branch, Dreikönigstrasse 21, Zurich, Switzerland
Lester B. Knight & Associates, G.M.B.H., Berliner Allee 47, Düsseldorf, Germany



The cores and this mold for a 426,000 lb steel casting were made by Mesta Machine Company with Venango sand — one of 35 grades of foundry sand available from Pennsylvania Glass Sand Corporation. Next time you need sand or silica flour for any casting requirement, contact PGS.

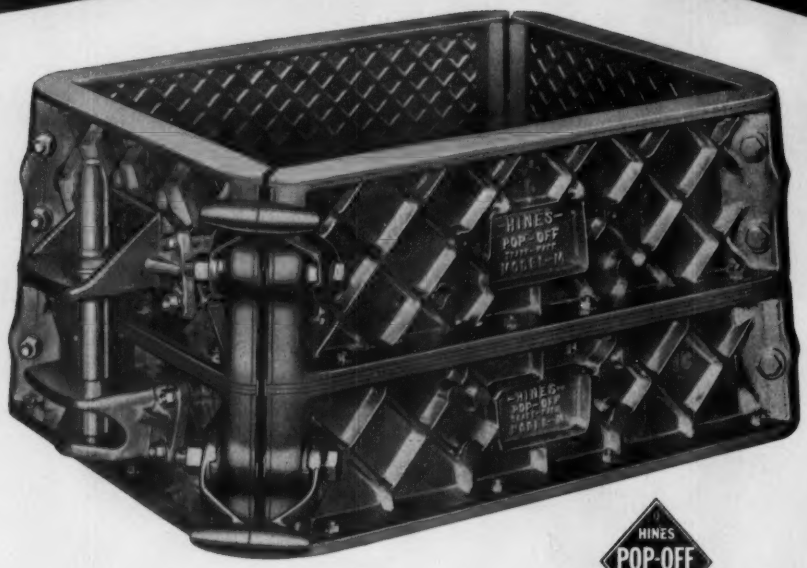
PENNSYLVANIA GLASS SAND CORPORATION

INDUSTRIAL SILICA DIVISION PIONEER SILICA PRODUCTS CO.

Sales offices in New York, Pittsburgh, St. Louis and Dallas · **Plants** in Newport, N. J. · Mapleton, Pa. · McVeytown, Pa. · Utica, Pa. · Berkeley Springs, W. Va. · Dundee, Ohio · Geauga Lake, Ohio · Phalanx, Ohio · Klondike, Mo. · Pacific, Mo. · Mill Creek, Okla. · Brady, Texas.

Circle 580 on Page 39

IF IT'S A "POP-OFF"... IT'S HINES!



HINES "POP-OFF" flasks have always contributed to better foundry production. The "POP-OFF" feature, a comparatively simple, but highly efficient and dependable method of opening flask corners, for easy flask removal, has often meant the difference between perfect molds and scrap.

IF IT'S HINES . . . IT'S THE BEST!

The
HINES FLASK CO.
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FEMA

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Slip and Tight Flasks,
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FIVE-DEEP

Millions have been made and saved

with UCM's "FIVE-DEEP" Ferroalloys

Metal producers in their ceaseless drive to improve products and profits are learning the value of Union Carbide Metals' FIVE-DEEP ferroalloys. Here are some of the advantages these alloys provide.

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1. **Technology**—many million dollars a year, invested in UCM's 600-man research and development center—helps you produce more profitable metals. The payoff has been progress—over 100 new alloys and metals—providing countless ways to improve your products.
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3. **Global Ore Sources** assure you uninterrupted supplies of ferroalloys. UCM's close association with many mines throughout the world provides dependable raw material sources.
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5. **Strictest Quality Control**—with over 100,000 tests per month from mines to shipment—makes sure you always get alloys of uniform size and analysis, with minimum fines, lot after lot.

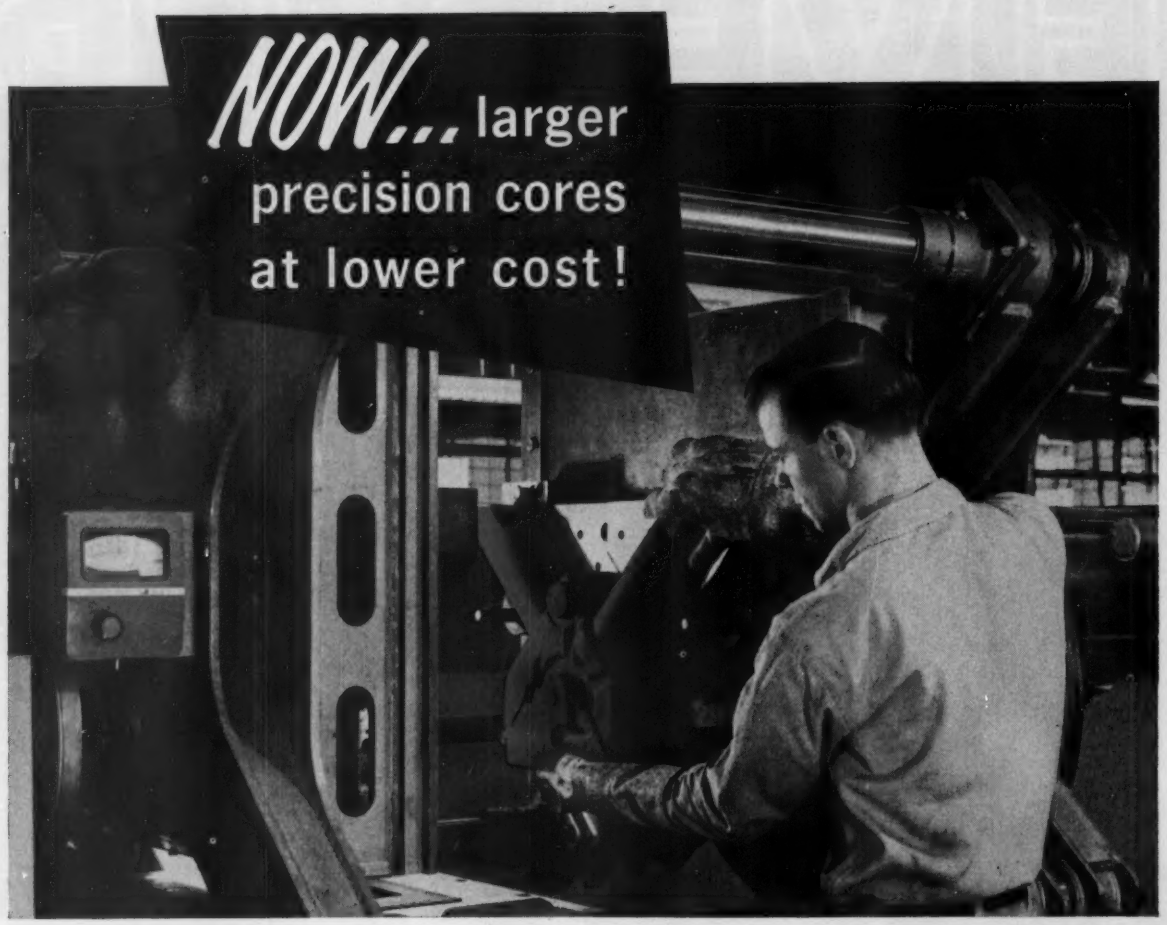
For better metals, production economies, bigger profits, insist on UCM's FIVE-DEEP alloys. Union Carbide Metals Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y., producer of "Electromet" brand metallurgical products.

"Union Carbide" and "Electromet" are registered trade marks of Union Carbide Corporation.

UNION CARBIDE METALS

Only **ELECTROMET** ferroalloys from **UCM** are so deep in extra values to help you.

Circle 582 on Page 39

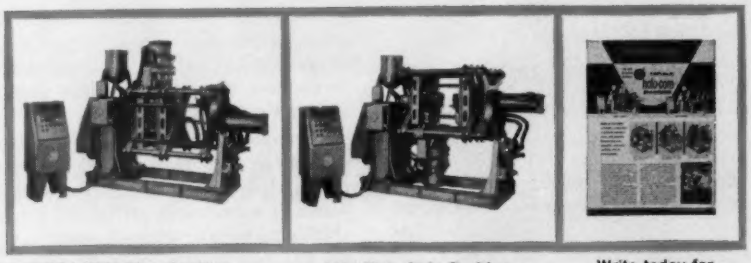


...with a SPO fully automatic TOP BLOW holo-core machine

Model SC-100 has a blow capacity of 100 pounds of sand . . . will mass produce large single-cavity hollow cores or a wide range of small cores in multi-cavity boxes . . . cores are delivered ready-to-use in 90 seconds or less depending on complexity. Large platens take core boxes up to 24″ x 30″ x 14″. Outstanding speed, simplicity, safety and economy are guaranteed operating advantages.

Other features include automatic gravity sand feed . . . integral direct-acting springless stripping mechanism . . . blow, dwell, drain-out and cure cycles that are timer-controlled and independently adjustable . . . gas-fired ovens are thermostatically controlled . . . simplified core box mounting . . . and shock-resistant heavy-duty construction throughout.

WORLD'S LARGEST SUPPLIERS SPO OF MOLDING MACHINES



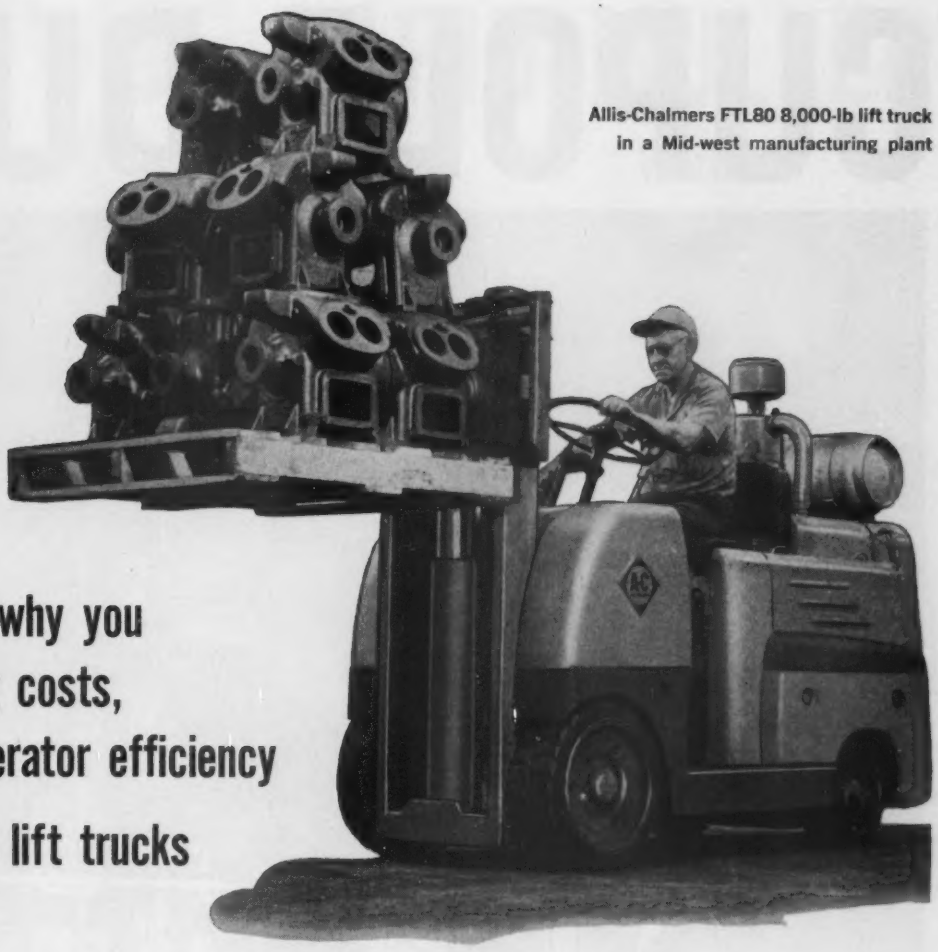
SC-100 in Blow Position

SC-100 in Strip Position

Write today for your copy of Bulletin SC-200

SPO INCORPORATED

6449 Grand Division Ave. • Cleveland 25, Ohio



Allis-Chalmers FTL80 8,000-lb lift truck
in a Mid-west manufacturing plant

10 reasons why you cut handling costs, increase operator efficiency with A-C lift trucks

1. Better performance, indoors or out, with heavy-duty Allis-Chalmers industrial engine.
2. Built for rough yard conditions. Rigid, deep-section steel frame takes stresses, holds parts in alignment.
3. Excellent balance of power and weight design permits outstanding gradability and stability.
4. Faster travel speeds match your job requirements.
5. Choice of standard transmission or two-speed POWER-SHIFT torque converter drive to fit your needs.
6. Operator works in comfort. Cushion seat is adjustable for leg room.
7. Choice of masts, plus many interchangeable attachments to fit your requirements.
8. There is extra reserve of electrical power for cold-weather starting, other needs, with 12-volt system.
9. New steel hydraulic lines eliminate chafing and vibration wear.
10. Less downtime because of outstanding ease of servicing and accessibility.

Let your dealer show you these and many other features of the better-than-ever Allis-Chalmers lift trucks.

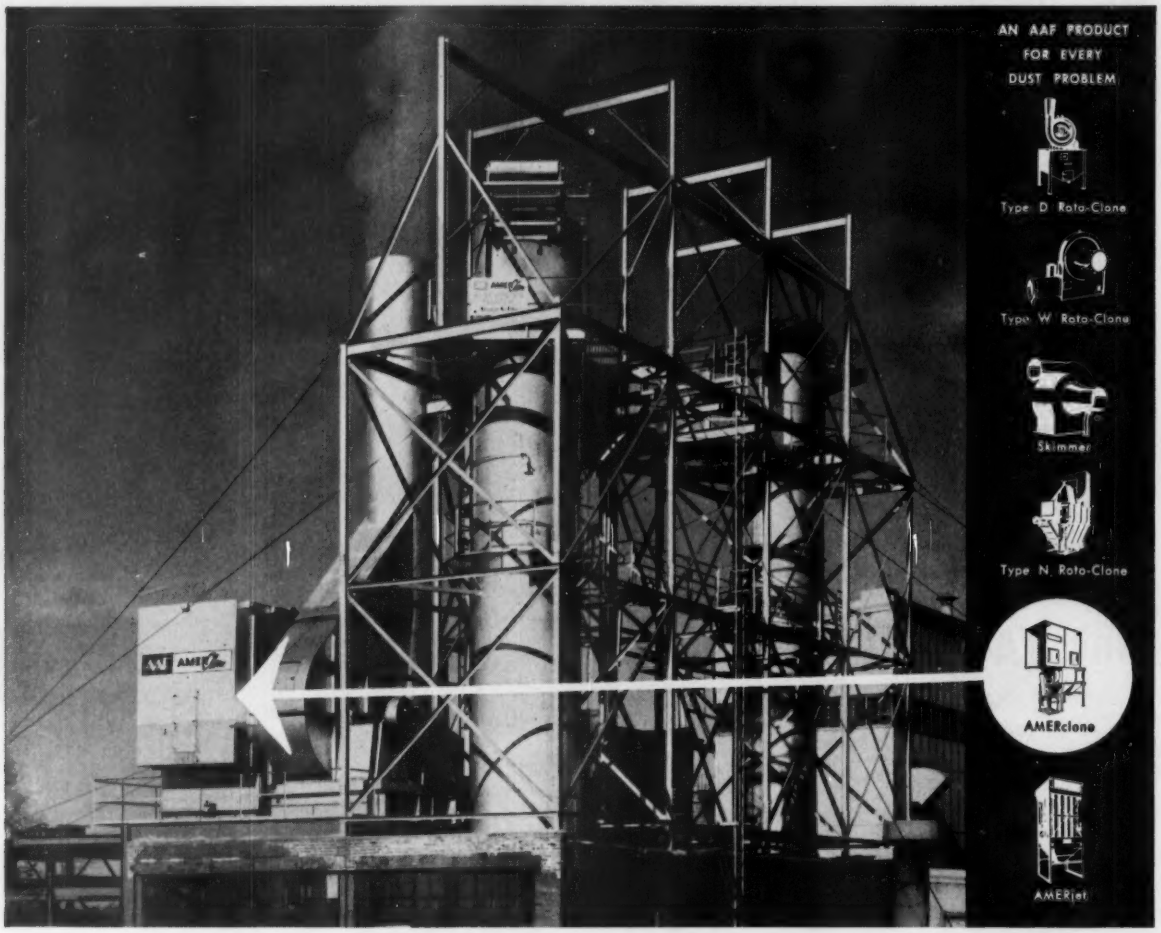
Allis-Chalmers, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS
***POWER* FOR A GROWING WORLD**

BH-151C

Circle 584 on Page 39

CUPOLA DUST



AAF AMERclone system arrests dust—coarse and fine!

● It's the *little* particles of cupola dust—the ones cinder catchers miss—that create the *big* problems: employee health hazards, fire risks, damage to roofs and parked cars, higher insurance and maintenance costs, poor in-plant visibility, neighborhood complaints.

But large cinders and tiny particles alike are captured by the AAF AMERclone cupola dust control system. They're collected *dry*, simplifying disposal and eliminating corrosion of the collecting system. And one AMERclone handles two cupolas alternately, permitting full-time use of equipment.

AAF's complete line of dust control equipment was application-developed, now challenges *any* foundry dust problem. If *your* problem is cupola dust, contact your local AAF representative or write direct for Dust Control Bulletin 291. Address: Mr. Robert Moore, American Air Filter Co., Inc., 266 Central Avenue, Louisville, Ky.

AAF American Air Filter
BETTER AIR IS OUR BUSINESS

Circle 585 on Page 39

Carver RAPID MULLER

Works Equally Well with Any Binder

including CO_2, Bentonite, Facing Sands, Oil Core Sands, Oil Bonded Molding Sands

- **The fastest! A batch every 75 seconds.***
- **Absolutely no lumps or wet spots!**
- **Easiest to clean! Just reach inside.**
- **Only one moving part. No maintenance worries.**
- **3 times lower initial investment than with most mullers!**

*Applies to CO_2 sand. Oil sand may take up to three minutes.

IF YOU COMPARE MULLERS CAREFULLY . . . YOU'LL CHOOSE CARVER

Only Carver Has Everything For the CO_2 Process!

CARVER RAPID and V & S Core Shooters

CARVER Automatic Gassing Apparatus

KRAUSS Taper Slot Core Vents

STEINEX available only from CARVER

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Send me complete information and prices on Carver Rapid Mullers.

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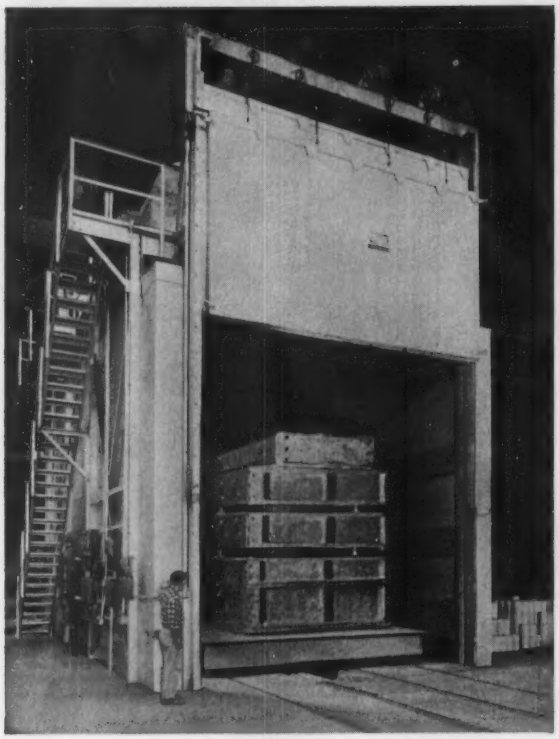
Circle 586 on Page 39

SURFACE DRY or "BONE" DRY
COLEMAN OVENS

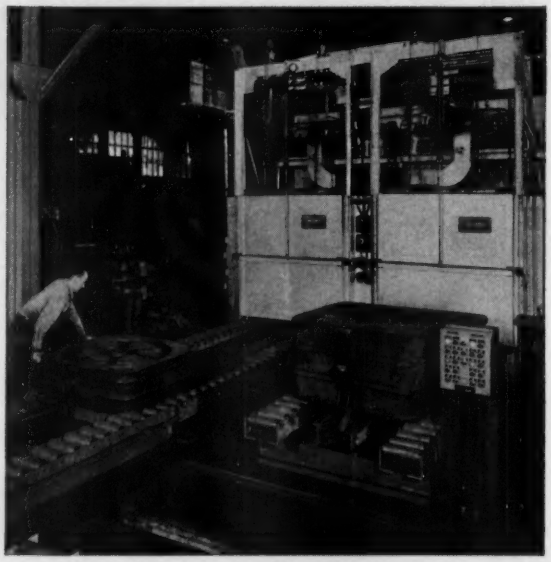


Dry Molds Best!

Below: Two Coleman *JET-ACTION®* High Speed Mold Ovens in a gray iron foundry dry up to 60 molds per day.

Ingenious push button controls enable one operator to index cope and drag molds through the oven on a semi-continuous conveyor system. Ovens are heated by individual *JET-ACTION®* Recirculating Systems.

Coleman *JET-ACTION®* Ovens provide such benefits of dry sand practice as better casting finish—fidelity to pattern—lower cleaning costs with added advantages of reduced handling costs and accelerated flask turnover.



Above: Car-Type Mold Oven in leading steel foundry is one of the largest in the world. Door opening is 16 feet wide x 18 feet high; useful inside work space is 11,000 cubic feet!

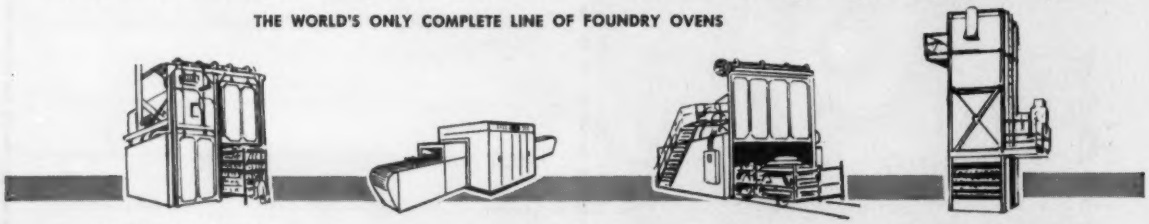
Combination gas and oil fired recirculating air system provides heating capacity to "bone" dry a 300 ton load of molds at temperatures up to 800° F. Heavy duty, sub-floor car moving system and doors at each end of oven are push button controlled.

Write for Bulletin 54.

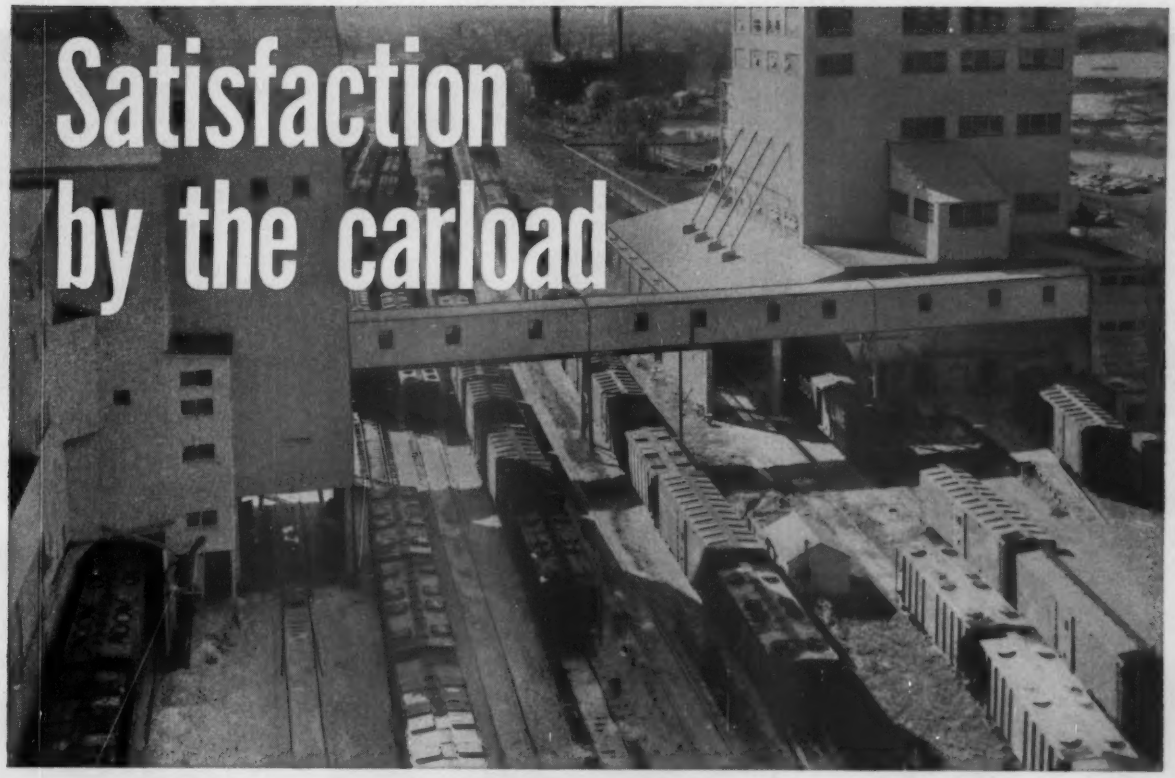
THE FOUNDRY EQUIPMENT COMPANY • **1821 COLUMBUS ROAD, CLEVELAND 13, OHIO**

World's Oldest and Largest Foundry Oven Specialists — More than half a century of specialized foundry experience.

THE WORLD'S ONLY COMPLETE LINE OF FOUNDRY OVENS



TRANSRACK OVENS | **DIELECTRIC CORE OVENS** | **CAR TYPE OVENS** | **TOWER® OVENS**



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Since 1900, customer satisfaction has commanded top priority here at Ottawa Silica Company. Uniformity and quality are bywords. Periodical expansion of plant facilities has maintained output at high levels. In keeping pace with growing industrial demand, Ottawa Silica Company over the last half century has become the nation's foremost supplier of silica.

Whether you order a bag or a carload, you are assured of the same steady quality that has earned for Ottawa silica, the distinction of being the world's finest.

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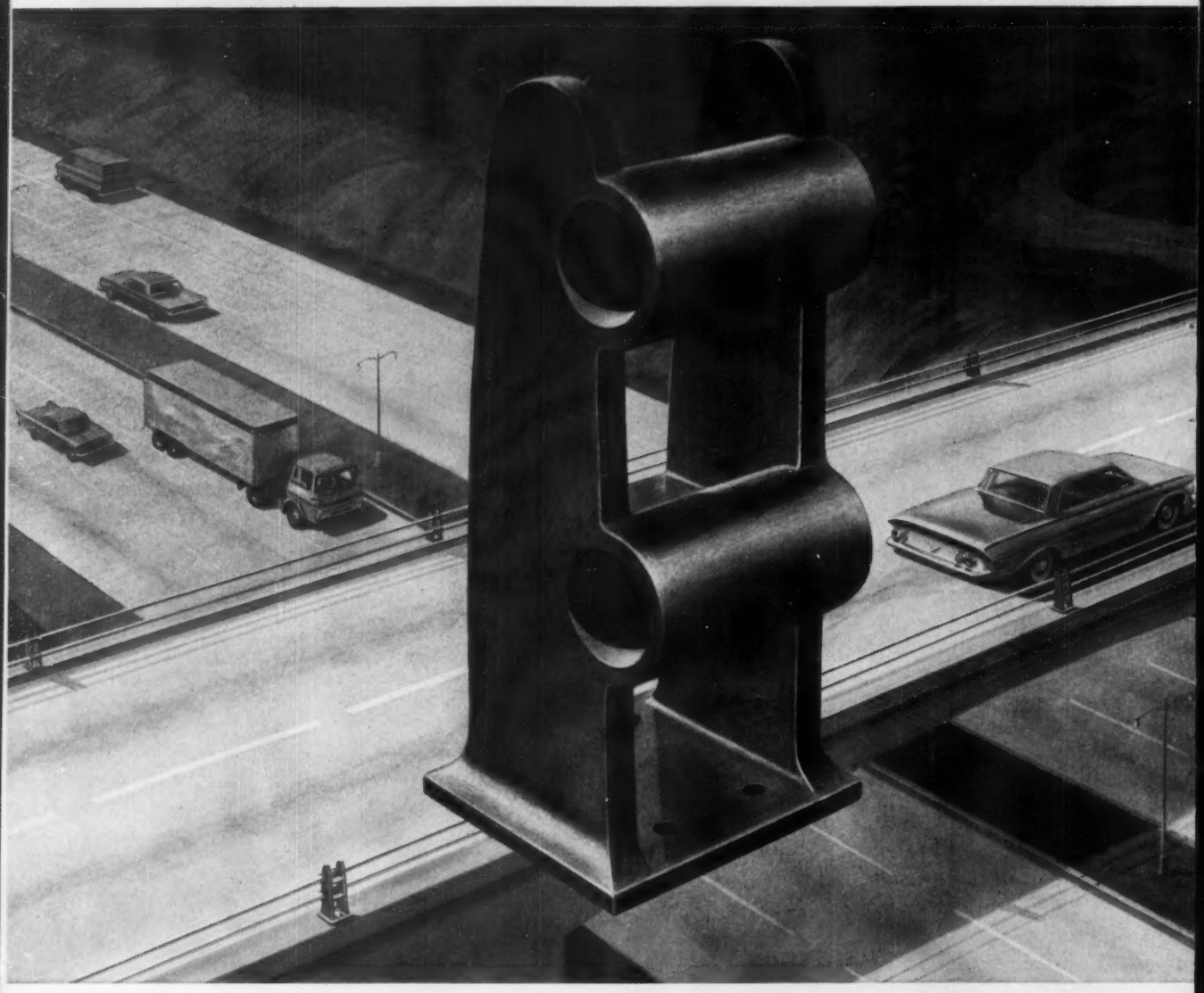
SERVING THE FOUNDRY, GLASS, CERAMIC AND CHEMICAL INDUSTRIES FOR OVER 50 YEARS

How the Foundry Industry Serves America . . . #13 of a Series



MALLEABLE IRON RAILING POSTS OFFER GREATER STRENGTH . . . CUT COST 13%

A higher standard of safety at a substantial saving in price has been achieved through the use of malleable iron bridge railing posts on the Connecticut Thruway.

Chosen over a fabricated component for its superior impact resistance and its strength to meet rigid safety requirements, the malleable iron supports saved the Highway Department approximately 13% on the cost of the units previously used. A saving in future maintenance is also assured through malleable iron's ability to retain a smooth finish against the corrosive effects of salt air.

This is just another example of how modern iron castings offer you superior benefits at substantial savings.

For the production of structurally sound iron castings, Hanna Furnace provides foundries with all regular grades of pig iron . . . foundry, malleable, Bessemer, intermediate low phosphorous, as well as HANNA-TITE® and Hanna Silvery.

Facts from the files of Malleable Founders Society

HANNA — THE BEST KNOWN NAME IN IRON

THE HANNA FURNACE CORPORATION

Boston • Buffalo • Chicago • Detroit
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Hanna Furnace is a division of **NATIONAL STEEL CORPORATION**

Circle 589 on Page 39

READERS' COMMENT

Design Data Available

To THE EDITORS:

I have reviewed with interest the FOUNDRY article, "Foundry Technology . . . Where Is It Headed?" in the January issue. Some of the points are well taken. However, there was one comment attributed to several contributors that information on design is not readily available to design engineers.

I wonder if you could call the attention of these contributors to the chapter on design in the Third Edition (1960) of the *Steel Castings Handbook*. This book came off the press in October of last year. In my opinion, the subject of casting design, as it appears in this book, is covered far better than by any other present or previous publication.

In fact, the design chapter appearing in the Second Edition (1950) of the handbook has been sent out in separate booklet form to about 45,000 engineers, and I imagine that the expanded and more detailed data of the design chapter of the Third Edition will go to even more engineers.

CHARLES W. BRIGGS
Technical & Research Director
Steel Founders' Society of America
606 Terminal Tower
Cleveland 13, Ohio

Editor's Note: Other foundry industry organizations in addition to the Steel Founders' Society of America have published books that include rather extensive chapters on casting design. They include *Malleable Iron Castings* (1960), Malleable Founders' Society; *How to Design and Buy Investment Castings* (1959), Investment Casting Institute; *Gray Iron Castings Handbook* (1958), Gray Iron Founders' Society, and *Cast Metals Handbook* (1957), American Foundrymen's Society. In addition, the Gray Iron Founders' Society has distributed nearly 10,000 preprints and reprints of the design chapter of its handbook.

Another Rat Race Is On

To THE EDITORS:

Since 1919 we have been engaged in the heavy machinery jobbing, gray iron foundry business. It isn't very often that I open my big mouth, but when I do, it is because I get so worked up inside that I must let it out or no telling what might happen.

We, in the foundry business, are now engaged in another "rat race." Now, in keeping with the great foundry tradition, comes a stupid price war that threatens the entire industry. Quotations for castings are now being made at ridiculous prices, way below the cost of production. I am told that heavy castings for metal forming dies are being offered by desperate foundrymen for anywhere from 8 to 11½ cents per pound and, as additional inducement, patterns are being picked up and castings delivered, no matter where, without charge. How stupid can this industry get?

For 20 years prior to World War II, the best showing that this industry ever made was 4 per cent before taxes. That is why it was frozen at that level during the last war.

I am grateful that I was not born in the foundry business, so I have no apologies to make for the policies that existed and, to a great extent, still exist in the foundry business.

This foundry business has been called a feast or famine business, but the average foundryman, who is a poor business man, does not know enough to hold on to the feast long enough to get himself through the famine. So, true to the foundry tradition, they start out cutting prices to attract business that isn't there, with the result that they wind up with terrific losses and completely demoralize the blockheads like me, who insist on holding onto some sensible price level.

I first came into the foundry business as a receiver. The foundry had come through a long period of making castings for the shovel industry, ballast weights at $2.98 cwt. They paid a salesman $5000 in three months to "sell" this business and lost more than that in the three months of production.

When I was appointed receiver, I said, "This is not for me." As a good business man I would make sure that I didn't wake up some day with all of the buildings falling apart and not enough money to replace them. I would make certain that I maintained an adequate cost accounting department to insure that

In the interest of the American foundry industry, this ad (see opposite page) will also appear in

STEEL
IRON AGE
MODERN CASTINGS
AMERICAN METAL MARKET

How the Foundry Industry Serves America . . . #18 of a Series
MALLEABLE IRON RAILING POSTS OFFER GREATER STRENGTH . . . CUT COST 13%
YOUR NAME HERE

FREE!

REPRINTS OF THIS AD WITH YOUR FIRM'S SIGNATURE

If you would like to have reprints of this ad to mail to your customers and prospects, let us know. Reprints will have no Hanna product message or signature, but will be imprinted with your firm name and address. Absolutely no obligation. To order your reprints, fill in and mail the coupon below.

The Hanna Furnace Corporation
Detroit 29, Michigan

Please send me_____ reprints of Ad No. (No.)
____ of your Foundry Industry Series.
Imprint as follows:

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Send reprints to:

NAME_____

I understand there is no charge for this service.

Circle 589 on Page 39

we would charge the right price—not over, not under—and make a reasonable profit.

This is the philosophy under which I lived and worked all of these years in the foundry business. Now, don't get the impression that I was a know-it-all. Far from it. There were times when I let a little of the foundry tradition rub off on me, but I always found it a revolting development and soon tired of losses, and I have refused, thus far, to meet the prices that are being quoted, and, as a result, I have seen a lot of our best business go down the drain.

I have said to many purchasing agent friends, "Here is a cost analysis showing our budget and budgetary cost formula indicating how we arrive at the prices we quoted. You ask other people who quote how they arrived at the prices they quoted, so you may be assured of a dependable source of supply." They shrug their shoulders and say, "If someone wants to go broke, we will help them."

It is clear to me that these fantastic quotations are not based on sound cost accounting principles, but purely on guesswork and the necessity for survival. In my opinion, it would be far better to wait out the economic conditions and maintain a price dignity.

How can anyone sell or produce castings that normally cost from 13 to 15 cents per pound at 10 to 11½ cents per pound including transportation two ways? What reason would there be to cut prices from 3 to 5 cents per pound this year? Where have costs been lowered in the last year? Only in scrap iron, and this is only a temporary situation and wouldn't amount to more than 1 cent per pound. There has been no reduction in the cost of pig iron or coke, and certainly no reduction in the cost of labor. Did we overcharge last year? I think not.

Once again foundries have been closing up all over the country and once again, after operating many years in the foundry business, I get a strange feeling that it is "love's labor lost."

WILLIAM LOVE
President and Treasurer
Colonial Foundry Co.
609 North Chapel St.
Louisville, Ohio

Your
CASTING QUALITY
Begins With
Foseco®

Foseco products for every casting application are compounded from quality raw materials scientifically blended to assure product uniformity. Each is quality controlled in Foundry Services' own laboratories, production tested in Foundry Services' own experimental foundry.

And Foseco's Technical Service is always available without charge or obligation. Call or write for competent, professional advice on your problem castings—or your routine foundry applications.

Foundries everywhere recognize Foseco superiority—for improved product quality and for lower casting costs.

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CLEVELAND 35, OHIO
Telephone: BErea 4-3551

A world-wide organization serving the chemical and metallurgical needs of the entire metal-casting industry.

ANOTHER WHEELABRATOR® COST CUTTING SOLUTION TO SPECIAL CLEANING PROBLEMS

SPINNER-HANGER CABINETS CAN ANSWER YOUR PROBLEM OF RISING OPERATING COSTS

Cleaning efficiency poses special problems for foundries handling a wide variety of castings, but having limited production of any individual part. If this is your situation, a Wheelabrator Spinner-Hanger Cabinet may be the means of stepping up your cleaning efficiency to the level of high-production shops, and reducing your cleaning costs at the same time.

Work that cannot be "batch" cleaned economically, yet whose volume does not warrant installation of high speed monorail equipment, can be blast cleaned with superior results in Spinner-Hanger Cabinets.

At Terre-Haute Malleable & Mfg. Co., for example, a two-wheel, four compartment Wheelabrator Spinner-Hanger Cabinet cleans castings that range from 40 to 300 lbs. in weight, and vary widely in shape. Compared to equipment formerly used, the Wheelabrator Cabinet cleans over three times as much work, with 1/6 the labor required.

Wheelabrator Spinner-Hanger Cabinets are designed to meet individual requirements of size of part, number of compartments, and design of the work-carrying fixture. All surfaces of the work receive the full effect of the hard hitting abrasive blast, to clean deep pockets, cavities and recessed holes with the same uniformity and thoroughness achieved in monorail cabinets, but at a fraction of the equipment cost.

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505 South Byrkit Street **Mishawaka, Indiana**
Canadian Offices: Scarborough (Toronto) – Montreal

For a complete description of Wheelabrator Special Cabinet applications, send for Catalog No. 105-D.

WORLD'S LARGEST MANUFACTURERS OF AIRLESS BLAST CLEANING EQUIPMENT AND STEEL ABRASIVES

Circle 591 on Page 39

Only on Shalco Shell Core/Mold Machines...

Gas or Electric core box heating...

your choice at no extra cost

Now, to meet your specific requirements, you can have either gas *or* electric core box heating on any Shalco shell core/mold machine . . . at no extra cost. In addition to this exclusive option, fully automatic Shalco machines offer . . . full design flexibility to accommodate the widest variety of cores and molds . . . adjustable cams for automatic blow in any position . . . thermostatic core box temperature control for accurate, uniform curing . . . rugged, precise construction for sustained, consistent performance. Whatever your needs in shell core, shell molding, shell sand coating and related equipment, Shalco can fill them. From machine selection on through the training of your operators, Shalco's unmatched engineering, manufacturing and service organization is at your disposal. CALL, WRITE OR WIRE FOR COMPLETE INFORMATION.

Shalco Division of National Acme

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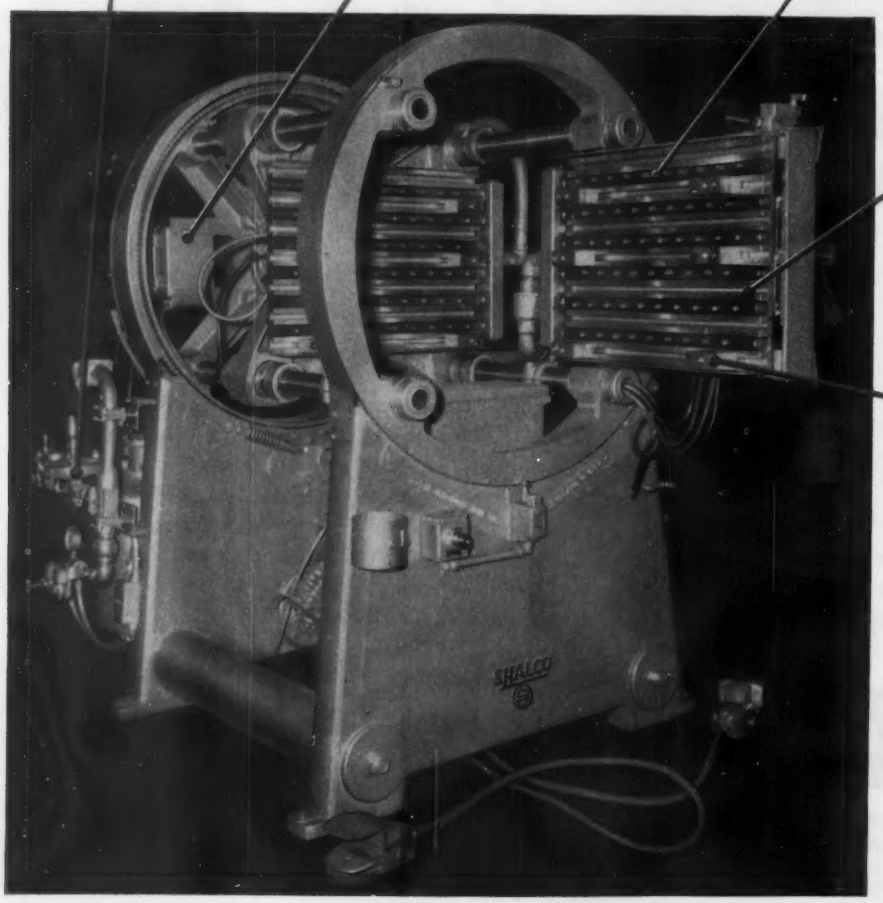
173 E. 131st STREET
CLEVELAND 8, OHIO

Sales Offices: Newark 2, N. J., Chicago 6, Ill., Detroit 27, Mich.

Gas Mixing Unit.

Thermostat heat control for high and low flame.

Manifolds arranged with removable blast tips which can be located to suit size of core box or heating requirements. Also, any complete line of tips can be shut off.



Back Plate complete with tee slots for block adjustment.

Adjustable blocks for securing core box—this allows for maximum area of box to be exposed to tips. Cold spots are eliminated with ample space available for tip lighting.

Circle 592 on Page 39

WHEREVER METALS ARE CAST... FOUNDRY

FEBRUARY 1961

How Designers Feel

Foundrymen with even a casual knowledge of marketing are aware that castings consumption has not kept up with the growth of the American economy as a whole.

This situation stems partly from technological changes which have eliminated some markets for castings, and from new materials and fabricating methods which do certain jobs better or cheaper. But these factors represent only part of the story.

The other part is vital to the continued, maximum growth of the castings industry, and it is in an area in which foundrymen can take positive, effective action.

Specifically, three reasons for the lag in castings consumption are 1) inferior casting quality, 2) inconsistency of quality, and 3) foundries' disregard of delivery promises. These points are brought out clearly in FOUNDRY's recent questioning of design engineers, as reported on Pages 106-107 of this issue. Let's look at them individually.

Of the 1030 designers who participated in this survey, 12 per cent complained—often bitterly—about the quality of the castings supplied to them. Their comments point to a clear conclusion: Many foundries don't take the trouble to do as good a job as they can.

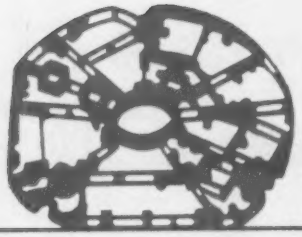
The engineers were bothered even more about the problem of consistency. The fellow who never makes good castings may at least have the excuse that he doesn't know how to do any better. But the one who makes good castings in one batch and defectives in the next proves only that he's careless or irresponsible.

Finally, the engineers point out that even consistently good castings are of little value to the user who had his production lines set up to use them a week before they arrived. A casting which isn't on hand when it's needed is no better than the one which isn't any good.

There's an obvious answer to these problems: Prompt delivery of a consistently good product. This simple step may be difficult for some foundries to take, but it would do more than any other single factor to increase the use of castings.

William G. Bude

Editor



CLOSE-TOLERANCE

Light Metal Castings

Tolerances as close as plus or minus 0.002 in. can be met by using a variety of casting methods. The author outlines what the foundry industry has accomplished with plaster and shell molds

By JOHN ARMSTRONG
Development Engineer
Sterling Metals Ltd., Nuneaton, England

● INCREASED demand for metal shapes of greater complexity, requiring less finishing and machining, has led to the development of new casting techniques for producing accurate castings in forms not practicable by conventional foundry methods. These techniques embrace a number of processes and are not intended to be competitive with normal foundry methods but to augment them.

This article is not concerned with technical details of the newer processes, which by now are well known, but rather with showing how a section of the industry is developing and consolidating methods to meet changing standards and requirements in a small, specialized field.

Can It Be Cast?—A cast part, like any other manufactured article, results from a compromise of various factors. The three main factors are design and function requirements, practical limitations of process, and economics.

If cost is plotted on a graph against standards of acceptance, it will be seen that cost rises to infinity as the perfection end of the scale is reached, whether from a metallurgical, x-ray, or tolerance viewpoint. Knowing at what quality level to stop is difficult, although in many cases economic considerations decide.

Suggestions often are made by the foundryman to simplify a casting design and thereby facilitate and lower the cost of production. This is a sensible thing to do, and commercial product designers normally will compromise their design requirements with practical and economic restrictions. However, remember that a basic feature of the casting process is its ability to produce complex shapes, and oversimplification can mean that the shape may be produced more easily by a competitive process.

The present trend is to obtain greater operating efficiency from smaller and lighter units, particularly in the aircraft and missile fields, and the designer should be encouraged to feel free to design complicated shapes. Whether or not an "impossible" shape can be cast often depends on how much the designer is prepared to pay, coupled with the skill and ingenuity of the foundryman. This outlook obviously should be restricted to areas of the casting important to its function in the finished unit.

Precision—The word "precision" is being used increasingly in the foundry industry to denote tolerances "something better than normal." Occasionally, the misguided use of the word has caused much confusion in the customer's mind.

Many foundrymen rue the day that they agreed to produce such and such a casting to certain tolerances only to find that the customer really meant to check to a precision standard. The resultant discussions are not always pleasant memories but do insure that caution is used in future.

Interpretation of the word "precision" depends to some extent on the basic training of the individual. For instance, a wood patternmaker would assume you meant 0.015-0.032 in., but a metal patternmaker would take it to mean 0.005-0.020 in.

On the other hand, a machinist or toolmaker would be thinking in the range of 0.001-0.005 in. and a gagemaker 0.0001-0.0005 in. These figures would vary to some extent depending on the specific industry in which the individuals were engaged.

The foundryman uses the word loosely to convey tolerances which

Fig. 1—These aluminum missile parts were cast in shell molds to tolerances of ±0.015 in. Center casting was molded with a total of 28 cores and weighs 4 lb

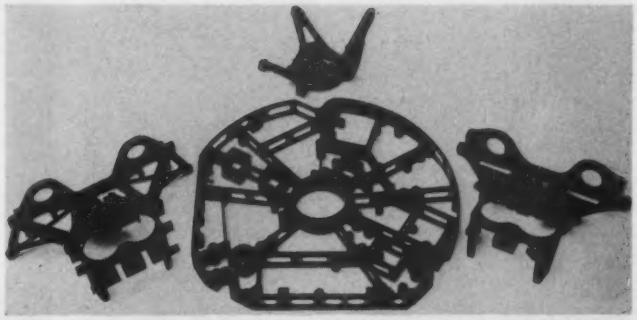
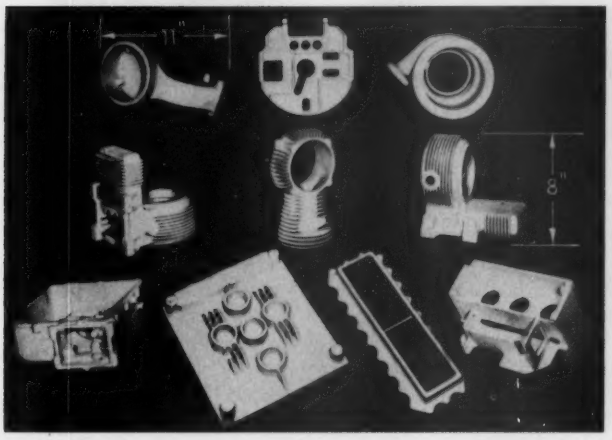
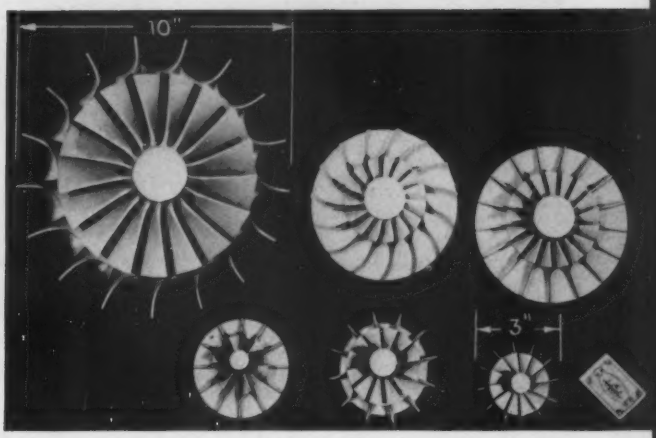


Fig. 2—Shell molding process was used to produce this selection of magnesium castings, primarily to get consistent results





may range from ±0.003 in. on specialized castings such as waveguides, to ±⅛ in. on larger, heavily cored work, and the responsibility is mainly on him to insure that he is talking the same language as is his customer.

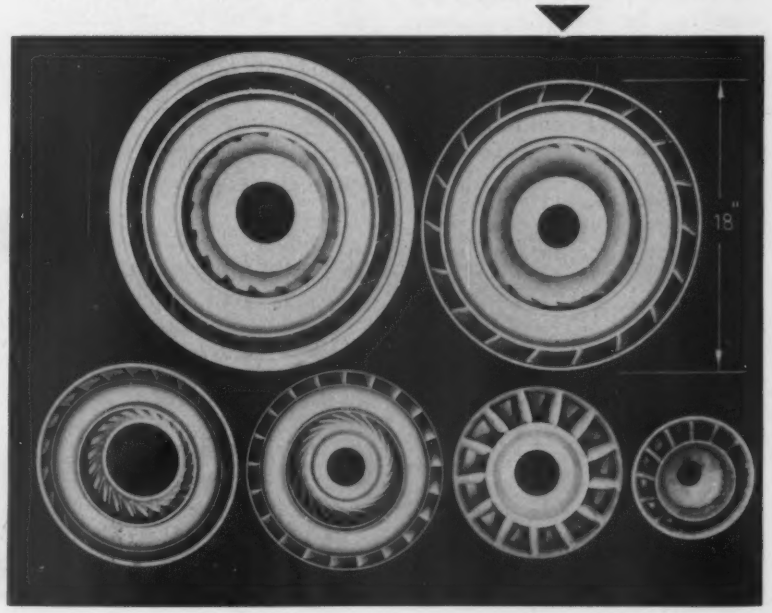
The question "to what tolerance can a specific casting be produced?" usually is among the first asked by an engineering customer. The answer often is not easy, particularly if the casting is heavily cored and is required in some exotic alloy to Class I x-ray standards.

Apart from the more obvious reasons for dimensional variation—such as pattern accuracy, mold and core consistency, and variation from normal contraction and cleaning, to name but a few—the following aspects often are overlooked.

The use of feeders and chill inserts obviously must be restricted, where possible, to faces which subsequently are machined. This is not always possible, and metallurgical considerations may have to override dimensional ones. Also, with complex castings, a number of samples usually must be produced and pattern adjustments made after each, before the desired results are obtained. Unfortunately, time is

Fig. 3—Since impellers may run at speeds up to 100,000 rpm, they must run true without excessive balancing. Plaster molds were used to cast these aluminum impellers, which weigh from 4 oz to 7 lb

Fig. 4—Various processes, including plaster molding, shell molding, and permanent molding, were used to produce these aluminum torque converter elements. Weight of the largest element is 36½ lb. Across the 18-in. diameter, the tolerances are within ±0.015 in.



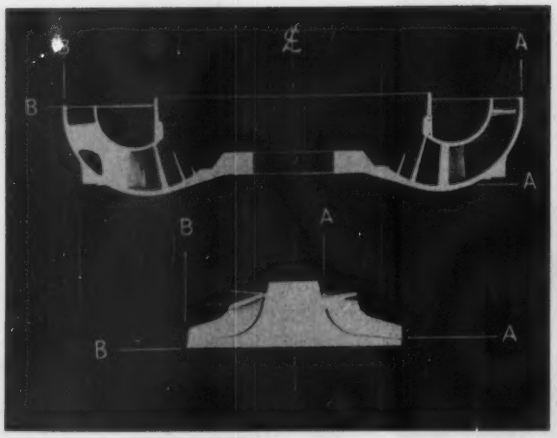


Fig. 5—Sectioned views show correct datum points, A, and datum faces machined by foundryman, B

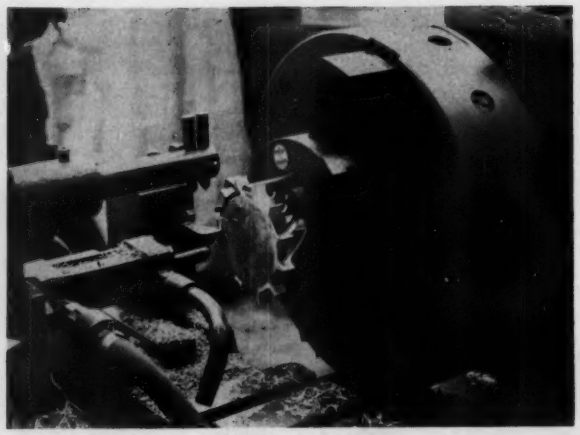


Fig. 6—Impeller casting is held in a simple setup while the datum faces are being machined

not always available to do this and dimensions may have to take second place to urgency.

An additional point to consider is that some aluminum alloys require a quench heat treatment to obtain the necessary properties. This creates the additional dimensional hazard of distortion. When all possible variations are considered, it is not difficult to see why doubt exists in many engineers' minds regarding casting tolerances.

The problem of dimensional tolerances is not straight-forward, particularly with castings having dimensions over 6 in. To quote a standard tolerance of so much per inch plus additional factors for core joints, across joints, and loose pieces often can be misleading, if only because the customer does not always know how the mold will be split and cored. Nevertheless, the foundry engineer can reduce the difficulties considerably, as will be seen later.

Consistency vs. Accuracy—A customer may talk about close tolerances when in fact he is more interested in consistency throughout the batch than in specific blueprint dimensions. The difference between consistency and accuracy to drawing may appear subtle, but the foundryman should ascertain with which type his customer is concerned.

A customer who is concerned with consistency often will alter his jigging fixtures, or even the drawing, provided he can rely on the castings being consistently "wrong." This practice may not be described in a textbook, but it is a practical approach which can save time when the only other solution to the problem is a complicated pattern change.

On the other hand, accuracy to drawing often involves making a number of samples and pattern adjustments before castings are accepted. This is particularly true with castings currently required in the aircraft and missile field.

Probably the biggest advantage offered by the shell molding process is that casting dimensions remain consistent throughout an order and rely very little on operator skill. The process in England has tended to be restricted to coremaking and to medium to long production runs. However, the complex aluminum missile castings shown in Fig. 1, which are required to Class I x-ray standards, have been produced by this process as have the magnesium castings in Fig. 2, primarily to obtain consistent dimensional results.

It often is said that the higher metal pattern cost for the shell process makes it uneconomical for small quantity production. But this depends on individual requirements, and the decision as to whether the higher cost is justified can be made only by the customer with his knowledge of the over-all cost when compared to use of alternative methods. In some instances, the shell molding process has been used to advantage to make as few as 20 castings.

Location Points—Location points are closely allied to casting tolerances. The machine shop operator often has little knowledge of foundry technique and considers the castings from the point of economic machining sequence and clamping

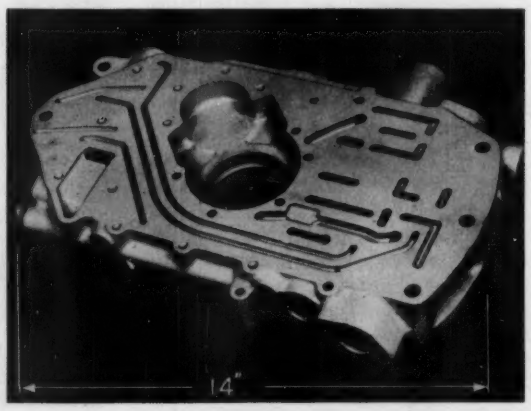


Fig. 7—Oil passageways in this shell mold aluminum transmission casting are cast-to-size, but the machining surfaces have an allowance of 3/32 in.

Fig. 8—Very thin sections can be cast in plaster molds because of the insulating effect of plaster

arrangement, with little regard for balanced conformation in the casting. This will cause no difficulty with simple shapes, but with castings such as the plaster-molded impellers and torque converters shown in Fig. 3 and 4, the situation is different. Impellers may run at speeds of 40,000 to 100,000 rpm in service, and they must run true to obtain greatest efficiency and to avoid excessive balancing work. Fig. 5 shows the correct location areas if the best results are to be obtained from the casting.

Machining of the datum faces, which run true and concentric with the above-mentioned surface, is important to the foundryman. Fig. 6 shows the simple set-up required to do this. The customer appreciates this service because he can set up the impeller casting and machine with confidence, knowing that the foundryman has split the errors and variations to obtain the best from his casting. The foundryman can design the pattern equipment so that the plaster cores which form the vane also carry a cast extension to aid in machining the locations.

Machining Allowance — Reduction of machining allowance must be done sensibly, and on the short-run, complex castings shown it is unwise to go below the normal 3/32 in. if minor subsurface defects are to be avoided. An important point, too, is that the setting operation prior to machining usually is more expensive than the actual machining, and with aluminum or magnesium alloys, removing 3/32 in. is as easy as removing 0.010 in., except on fragile castings.

Eliminating the need for machining is another matter, and this often can be done if limits of about ±0.010 in., depending on the casting, are acceptable. Here again, if the machining operation saved is a simple one, such as turning or flat milling, a higher foundry scrap due to tighter dimensions may more than offset any saving in machining time.

The oil passageways in the shell-molded automatic transmission casting shown in Fig. 7 have been cast to size, but a normal 3/32-in. allowance has been left on the various metal-to-metal joint surfaces and bored holes. Obviously, the casting process cannot hope to compete economically or tolerance-wise with the more straight-forward machining operations.

Finishing Operations—Finishing and checking operations, subsequent to knock-out, often prove to be the major portion of production costs for close-tolerance castings because:

1. Inspection standards are higher, and minor surface irregularities, which normally would be masked in a sand-cast surface, are more pronounced when seen against a smooth background, making careful correction necessary.

2. The degree of skill required to finish the type of castings illustrated is higher due to closer tolerances, smoother surface, and to the

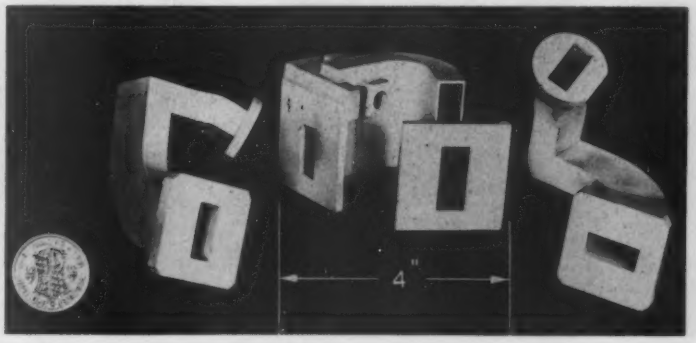


Fig. 9—Aluminum waveguides are cast in plaster. Weight of center casting is 4 oz, tolerance on the inside is ±0.004 in., and wall thickness is 0.045-0.050 in.

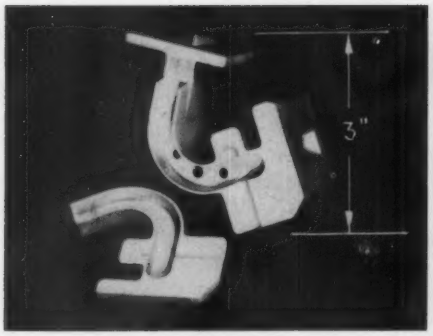


Fig. 10—Sectioned view of waveguide casting shows interconnecting holes. Tolerance across the diameter of these holes is ±0.002 in.

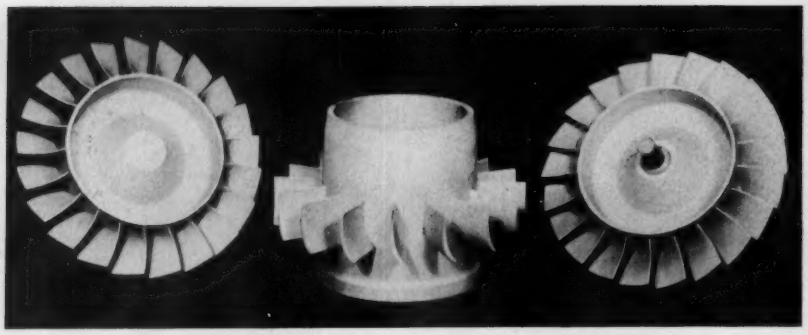


Fig. 12—Magnesium impellers and stator were centrifugally-cast in plaster. Weights of these two castings are 12 oz and 1 lb 12 oz

generally more fragile nature of shape.

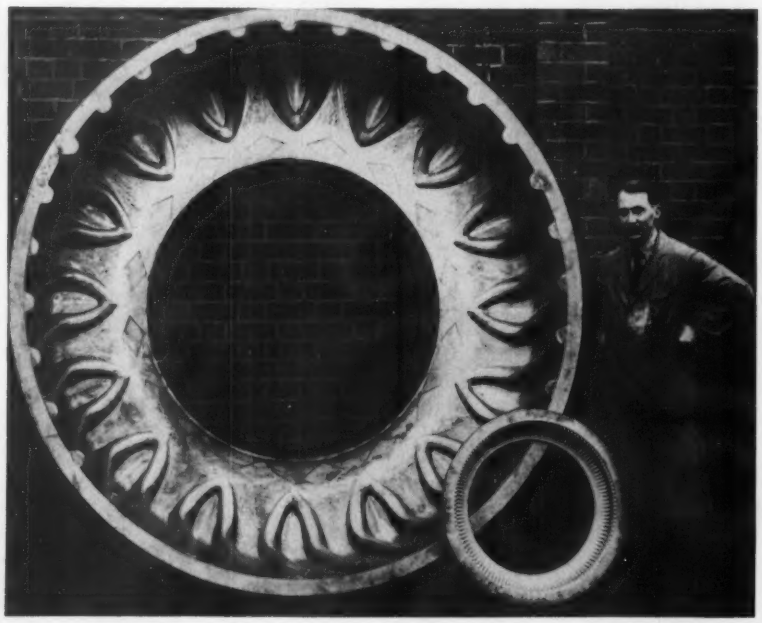
Surface Finish—The use of plaster as a mold material offers a number of advantages. One of these is its ability to impart a smooth surface texture to the casting. Surface smoothness in itself, however, normally is not justification for the use of plaster. Skilled use of fine sands gives a comparable result, particularly if external surfaces of the casting are buffed, an operation which is not always difficult or expensive.

However, many shapes such as torque converter elements, turbocharger impellers, fans, and stators, require smoothness in inaccessible areas, plus close dimensional accuracy. The molds in Fig. 8 show the type of shape which benefits most from the use of plaster. The insulating effect of plaster is an additional advantage with this type of casting inasmuch as thinner blades can be produced. Thicknesses of 0.050 in., tapering to 0.010 to 0.020 in. at trailing edges, are common.

The internal areas of the waveguides shown in Fig. 9 were formed by plaster within a tolerance of ±0.004 in. on cross-sectional dimensions, with 0.04 to 0.05 in. adjacent wall thicknesses. Machined metal inserts subsequently etched away are located in the plaster cores to form connecting holes within ±0.002 in., as shown in Fig. 10.

Use Flexible Patterns—Another advantage of plaster is its ability to solidify from a liquid, thus enabling its use with flexible patterns to form the intricate shapes required in modern tire molds (Fig. 11). Also, steel siping blades can be inserted into the plaster cores and subsequently are locked into the aluminum tread ring to form the slots in rubber tires. Many interesting shapes are produced by this plaster-rubber method, and it is being used increasingly for casting toy molds.

Fig. 11—Earthmover tire mold was cast in a composite mold of plaster and CO_2-bonded sand. The large aluminum casting weighs a total of 1764 lb. Tolerances on the 86-in. diameter are +0.010 in. and −0.080 in.



The castings discussed so far have been made of aluminum, but magnesium also is cast successfully in plaster molds, mostly for prototype castings. The air conditioning impeller and stator shown in Fig. 12 are examples of these. Plaster molds for magnesium must be sprayed with inhibitors to prevent oxidation.

In casting impellers we encountered a problem, due to the low specific gravity of magnesium, with producing thin blade tips. The solution was to increase metal pressure, and this was done by casting centrifugally.

The surface finish on shell-molded magnesium castings is better than normally obtained with green or dry sand practice, but this is not the case with shell-molded aluminum castings. They tend to have a fine, orange-peel surface.

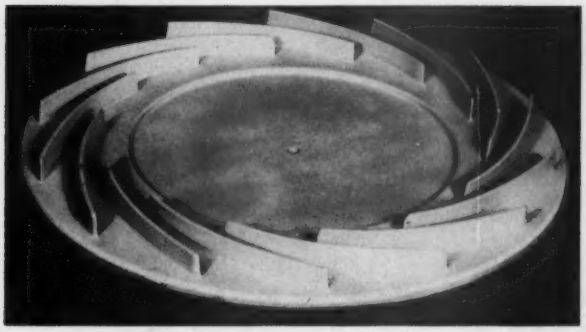


Fig. 13—Aluminum diffuser plate was shell-molded and weighs 3 lb 6 oz. Blade thickness varies between 0.050 and 0.060 in.; tolerance is ±0.010 in.

Fig. 14—Torque converter elements in large number are cast in permanent molds with plaster cores and shell base core; tolerance is within ±0.015 in.

This is quite satisfactory for most castings, but was not good enough for the diffuser plate, shown in Fig. 13, which had proved difficult to produce with a plaster core. A recently-developed technique whereby a refractory wash is sprayed directly on the corebox prior to making the shell in the normal way provided the answer, and cast surfaces equal to plaster are obtained.

Combining Processes—Frequently, requirements throughout a specific casting vary, and a combination of techniques may be used to get the desired result. The molds for torque converter elements in the foreground of Fig. 8 are an example. The diameters of these castings may be up to 18 in. and must be consistent within ±0.015 in. The use of a shell base core gives this result.

The individual plaster vane cores which impart the smooth surface to the internal oilways are positioned on the shell base, and the assembly of cores is set in either a green sand mold for prototype quantities or in a permanent mold assembly, as shown in Fig. 14, for production quantities.

Pattern Equipment—Patterns are of prime importance, not only in the manner of construction, which can be left to the skill and ingenuity of the craftsman, but in the determination of molding methods, print sizes and shapes, contraction allowances, and other considerations. These decisions should be made by the foundryman in cooperation with the patternmaker.

Patternmakers have a natural tendency to consider pattern equipment as an end product, rather than as a means to the end of producing a casting. Traditional patternmaking methods and outlook must be modified slightly if the most is to be obtained from both the shell and the plaster molding processes.

The factor of contraction illustrates the type of problem encountered. For example, the normal allowance for aluminum is 0.013 in. per in., but this may vary considerably, depending on collapsibility of the mold, the alloy, and shape of the casting. The casting shown in Fig. 1 contracted only 0.005 to 0.008 in. per in., whereas circular rings, such as tire molds, contract 0.008 to 0.010 in. In drawing pattern equipment, allowance also must be made for contractions or expansions which occur during the moldmaking process.

A general rule in foundry practice is to mold as much of the casting form as possible and to use loose pieces in preference to cores. This practice particularly is advantageous with the shell molding process. Deep, narrow projections of sand can be stripped clear with shell, thus reducing the number of cores required.

For a number of reasons, aluminum is not generally recommended as the best material for shell mold pattern equipment. But for the short production run castings, with which this article is concerned, it is used extensively, mainly because of the relative ease with which it can be worked.

The use of plastic for coreboxes has provided the answer to the problem of producing large numbers of identical coreboxes required for plaster impeller work. These coreboxes can be produced directly from a machined precision master core. The individual plaster core technique insures that the passageways are identical and allows the designer flexibility with little restriction on shape.

The author wishes to express his appreciation to the directors of Sterling Metals Ltd. for their permission to publish this work, and to his colleagues for their help in its preparation.

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F U R A N

Hot Box Core Binders

Furan resins are gaining wide interest as foundry sand binders because of many properties. This article outlines some applications and explains how to use the latest developments in hot box cores

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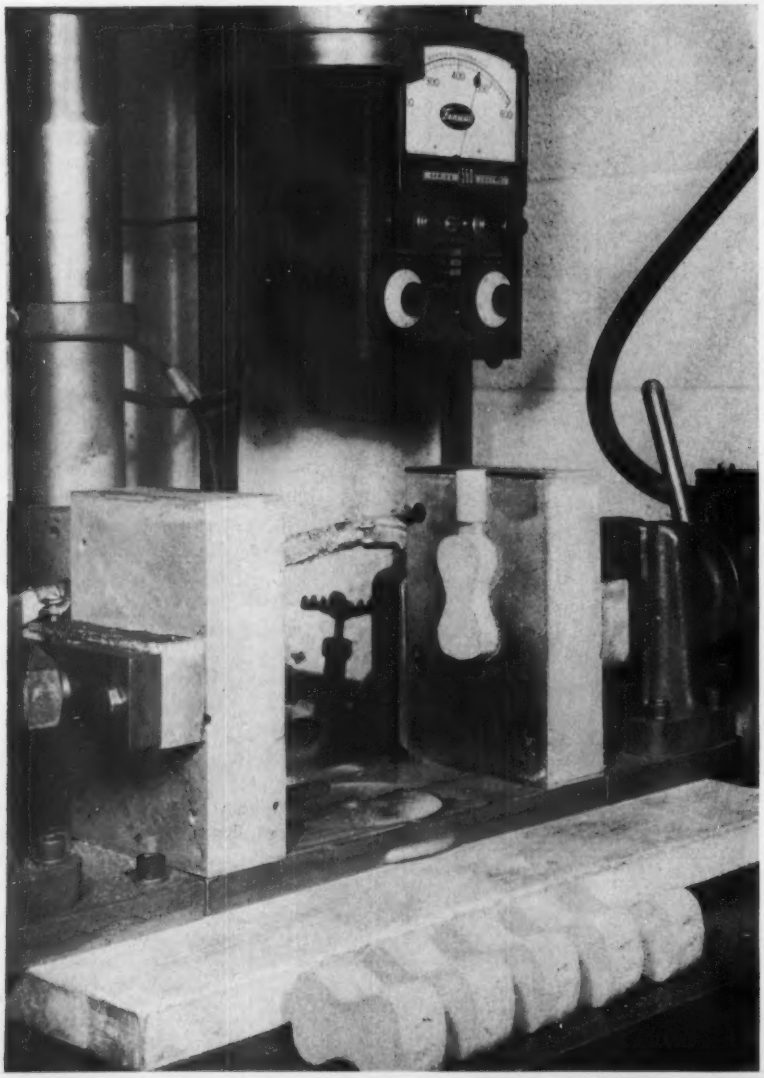


● WORLD-WIDE interest recently has developed in the use of furan resins as foundry core and mold sand binders. Furan is a chemical compound, but the term "furan" is a name currently associated with a class of rapid curing synthetic resins.

On the basis of molecular structure, furan is the parent substance of all the furan derivatives. In practice this distinction belongs to furfural, a chemical of commerce produced in large quantities from compounds present in, for example, oat hulls, bran, and corn cobs. Specifically, furfuryl alcohol is the furan derivative used as one of the raw materials to produce the liquid "hot box" resins discussed here.

Modification of furfuryl alcohol with other resin-forming components gives rise to a large family of so-called furan core binders. These binders vary widely in physical and chemical properties, performance, and cost. In common, they are thermosetting and exothermic in contact with weak acid solutions or

Fig. 1 — Hot box tensile test equipment. Tensile test specimen has regular AFS dimensions with a thickness of 1 in.

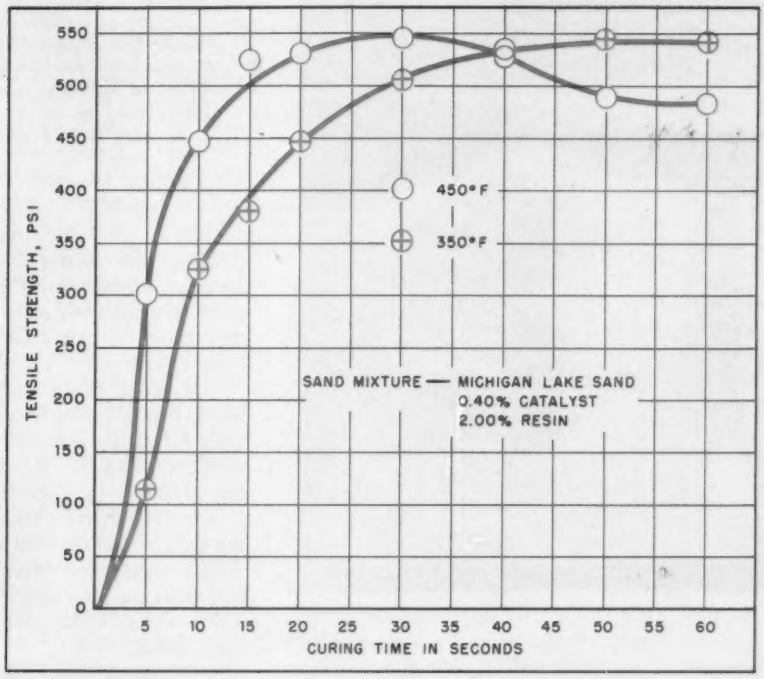


Fig. 2—Curing time of furan resin bonded sand varies tensile strength as shown in this plot. Effect of temperature is indicated

powders known as catalysts or accelerators. At elevated temperatures the curing time of furan resins is measured in seconds. The unique properties of these resins permit production of sand cores and molds in less time than it takes to heat sand.

Sand Coating and Testing—Resin and catalyst are mixed with dry sand. The coated sand is blown into a heated corebox, Fig. 1. This tensile test specimen has standard AFS dimensions, thickness 1 in. Heat from the pattern initiates a thermosetting and exothermic chemical reaction. After a few seconds the core has a hard shell and may be stripped from the pattern. The center of the core is soft at this time; however, due to the exothermic properties of the resin the center section of the core cures completely after it has been stripped.

A typical sand mixture may contain 2 per cent resin and 0.4 per cent catalyst based on the weight of the sand. The catalyst solution is added to dry sand and mulled for a short period of time—15 to 45 seconds depending on the speed of the muller. Following the catalyst addition, resin is added and mulling continued one to four minutes or until the resin and catalyst are thoroughly distributed. Overmulling is possible with warm sand or if much heat is developed in the muller. Extra mulling in cold sand is recommended.

TABLE I—Tensile Strength (psi) vs. Curing Time

	Curing Time In Seconds							
Temp.	5	10	15	20	30	40	50	60
350° F	112	324	380	447	504	533	542	539
400° F	174	384	467	515	556	531	523	510
450° F	298	445	524	528	544	527	488	482

An ideal temperature for prepared sand as it is discharged from the muller is 70 to 80° F. If the sand temperature is 50 to 60° F, the mulling time should be increased to assure complete mixing. If the sand temperature is 80 to 90° F, the mulling time should be decreased. Furan resin coated sand is damp because of the liquid resin and catalyst. It has good flowability and blowability but is not free flowing. Properly coated sand should not be gummy. The green strength of Michigan lake sand containing 2 per cent resin and 0.4 per cent catalyst is 1/10 psi.

Tensile strengths of furan resin bonded test cores at various times and temperatures are shown in Fig. 2 and Table I. The sand mixture used to obtain these data was Michigan lake sand, 0.4 per cent liquid catalyst, and 2 per cent of furan resin based on the weight of the sand. Test bars were cooled to room temperature before they were broken. The surface hardness of core test bars was 90 to 95 when stripped. Their centers were hard in approximately five minutes after they were stripped, and maximum strength developed in 20 minutes. Between curing times of 5 to 10 seconds, it is significant that furan resin coated sand in a 350° F hot box develops strength at the rate of 40 to 50 psi per second.

Applications—Furan resin coated sand is especially applicable to shell molds or cores which have a thickness of 1 in. or less, and where the shell is blown between hot cope and drag patterns. Cores up to 3 in. thick may be cured in hot patterns, but it must be remembered that the exothermic heat developed by the resin reaction is, by itself, not sufficient to bring about the complete curing of a core. Additional heat from some source is required. This may be provided in the form

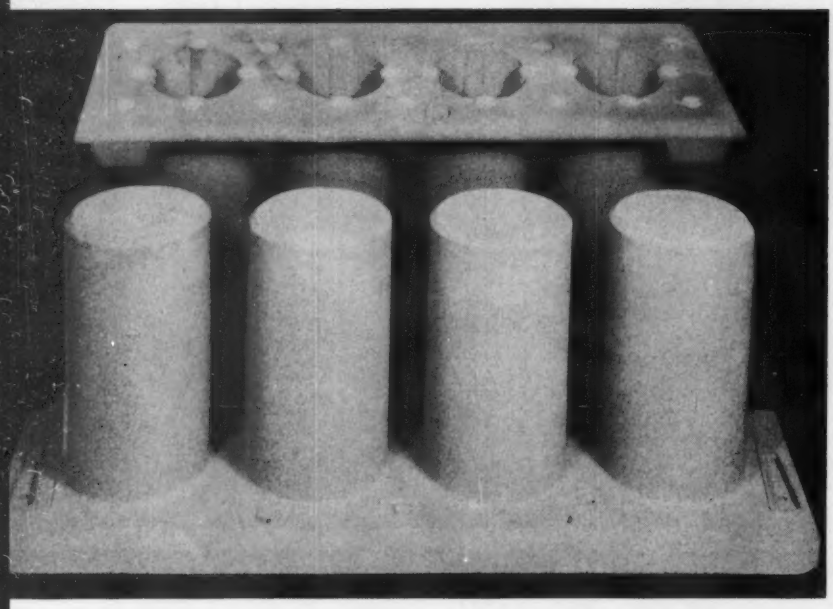


Fig. 3—This automotive barrel core has been made hollow with contoured lightener; core thickness is held to ½ in. Weight of the core is 13.9 lb

of a hot pattern or any other source of heat.

Furan resins are not recommended for most shell cores made by the blow and drain process or dump box procedure. Thick - section cores should be made hollow with tapered plugs or lighteners contoured to the inner core surface, Fig. 3 and 5.

The automotive barrel core, Fig. 3, weighs 13.9 lb. Hot pattern time is 25 seconds at 450° F. One machine equipped with a water-cooled blow plate, one blow head, two 4-cavity boxes, and two stripping stations, produces 540 cores an hour. The core is blown through the ⅞-in.-thick slab. The sand section on the barrels is ½ in. thick. Mandrels which form the hollow barrel on the cope half of the hot box are tapered and ribbed. This core formerly was made with phenol-formaldehyde coated sand. With furan resin coated sand, hot pattern time was reduced 65 per cent and complete cycle time more than 50 per cent.

The core surface has maximum hardness when stripped, and the thickest section is cured throughout and is water resistant in 20 minutes. The cores then are dipped in a water-base core wash and dried in an oven at 350° F. The slab does not warp, and cold core dimensions are almost exactly the same size as the cold pattern. Core dimensions are uniform and as accurate as the dimensions of the hot box. Collapsibility of the core poured in gray iron is rapid and complete, but the mold stability of this furan resin core improves casting dimensions—particularly desirable in the cylinder core of an automobile block.

The automobile block jacket, Fig. 4, formerly was made with oil sand. Now made in hot boxes with furan resin, the advantages are much improved core dimensions, less wall movement when the casting is poured, and better collapsibility. Moisture absorption by cores in the mold is greatly reduced. Hot pattern time on this core is 20 seconds at 450° F.

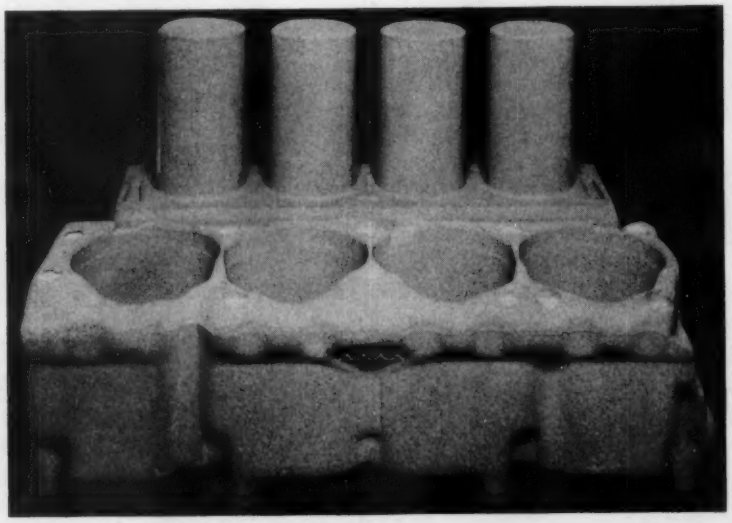
The end core for an automobile block, Fig. 5, formerly was produced with oil sand, and with the print weighed 30.44 lb. When hollowed out as shown in Fig. 5, and made in a hot box with furan-coated sand, the weight was reduced to 8.875 lb. When cured, and while it is still hot, this core is sprayed lightly with a core wash. It does not have to be oven dried.

The group of cores shown in Fig. 6 have sections up to 3 in. thick. These cores are intended to show the variety and type that are being produced in hot boxes with furan resin coated sand.

The two cores shown in Fig. 7 are automotive exhaust manifold cores. Hot pattern time on these cores is 20 seconds. The center sections are cured in 10 minutes after the core is stripped. Core wash is not used on these cores.

Advantages—No special mixing

Fig. 4—Automobile block jacket shows improved core dimensions, less wall movement, and better collapsibility when made with furan resin bonded sand



equipment or heat is required to coat sand. Compared to other hot pattern resin coated sand applications, furan cores are produced in less than half the time. Fewer machines and less space are required. No waxes or stearates are required as sand additions. Pattern sprays are used only occasionally. There is no buildup on the hot patterns and lower maintenance cost.

For a given quantity of sand, lower temperatures and less heat are required. Laminations near the core surface are eliminated. Cores do not warp on cooling and they possess a high degree of stability in the mold, resulting in improved casting dimensions. The cost of coated sand and the savings which accumulate from the foregoing contribute to over-all lower castings costs.

Production Equipment — Important considerations relative to equipment for making furan cores are (1) a water-cooled blow plate with unrestricted blow holes. Furan resin coated sand has enough green strength to prevent sifting through blow holes. (2) Adequate blow bushings and air release vents. Slotted steel vents are recommended. Coreboxes are rigged much the same as for oil-bonded sands. (3) A method of heating patterns. Gas or electricity can be used depending on job requirements. Automatic temperature control is desirable. (4) Air pressure between 50 and 100 lb, and (5) Automatic stripping mechanisms and pickout devices.

TABLE II—Curing Time of Coated Sand at 200°F

Curing time, seconds	50	60	70	80	90	100
Tensile strength, psi	52	125	200	228	268	290

Temperatures and Curing Times —The average pattern temperature range for curing furan resin coated sand is 425 to 450° F. A temperature of 375° F can be used at longer curing times and 475° F at shorter curing times. Where time is not a factor, 300° F patterns are adequate. In all cases one should be guided by the appearance of the cured core. Best results are obtained if the core is not burned. When severe scorching of the core surface becomes apparent, the pattern is too hot. If cores fail to cure throughout within a few minutes after they are stripped, the pattern is not hot enough, the cure cycle is too short, or the sand is not mixed properly.

It may be expected that a core 1 in. thick, made with 2 per cent resin in Lake Michigan sand, will cure sufficiently so that it can be stripped from a 450° F pattern in 10 to 20 seconds. This core will have a hard shell with uncured sand in the center when it is stripped. The hot shell will have a scratch hardness of 90 to 95. As the core cools, the center hardens and the cool core may be expected to have a tensile strength of 350 to 500 psi, depending on sand fineness.

Failure to make high-strength cores may be traced to (1) poor mixing of resin and catalyst with sand, (2) too hot patterns, (3) spongy or low-density cores due to low blowing pressure or inadequate blow bushings and air release vents. The most common error which may not be immediately apparent is incomplete mixing of resin, catalyst, and sand.

Bench Life of Coated Sand— Properly coated sand stored at room temperature—for example, 75° F—has a useful bench life of three to five hours. Beyond this time the sand may be good, but tests prove that after two hours the sand gradually loses strength. At somewhat elevated temperatures it is important to know the behavior and life of sand because of heat which may be conducted to storage in a hopper or because sand is warm in summer. The information in Table II is intended only as a guide to behavior of coated sand during its bench life. It indicates tensile strength of furan resin coated sand

Fig. 5—End core for automobile block weighed 30.44 lb when produced with oil sand. Hollow core made from furan resin bonded sand weighs only 8.875 lb

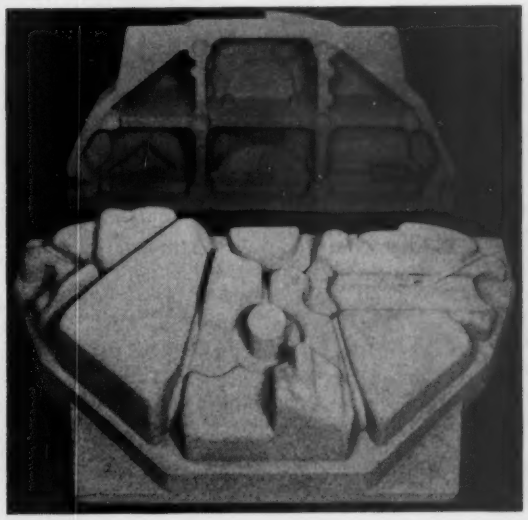


Fig. 6—Group of cores shown here demonstrates the variety being produced with the use of furan resin bonded sand. These have sections up to 3 in. thick

TABLE III—Green Strength of Coated Sand Stored at 100° F

Time, minutes	5	10	15	20	25	30
Green strength, lb	0.18	0.20	0.26	0.26	0.28	0.28

after various cure periods at 200° F.

The tests on which Table II data are based were made by blowing sand into a hot tensile test corebox at 80 lb pressure. At times of less than 50 seconds, cores did not develop enough strength to be removed from the pattern. The strengths recommended in the table were measured after cores were removed from the hot pattern and allowed to cool.

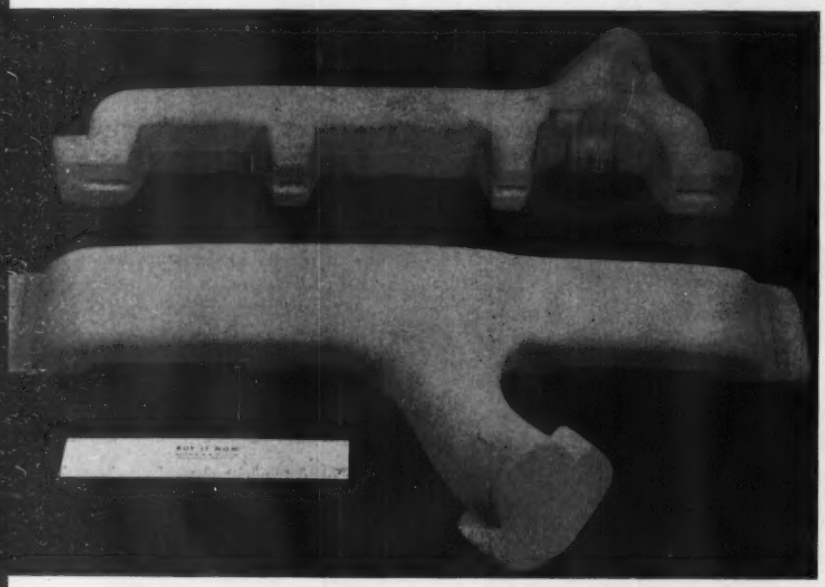


Fig. 7—Hot pattern time on these automotive exhaust manifold cores is 20 sec. Center sections cure in 10 minutes after cores are stripped

In a 150° F oven, furan test cores will not cure sufficiently for handling in a period of 25 minutes. Examination of coated sand indicates, however, that the green strength of sand stored at 150° F increases from 0.20 lb at five minutes to 0.75 lb at 25 minutes, and the sand hardens in 30 minutes.

Table III shows green strengths measured with furan resin coated sand stored in an oven at 100° F. At this temperature flowability decreased more than might be expected from these data.

Types of Sand—Any clean, dry sand may be used with furan resins. One-half to 1.0 per cent of resin in zircon sand will develop 400 psi in five seconds at 450° F in a hot corebox. Two per cent of resin in Michigan lake sand will develop 525 psi tensile strength in 15 seconds, in a hot box at 450° F (see Table I and Fig. 2). Three per cent of resin in Juniata bank sand will develop 400 psi in 30 seconds at 450° F.

Mold Release Agents—Core release from hot patterns is remarkably good. No mold release agents are incorporated in the sand. Pattern buildup is negligible. Any corebox in which resin bonded or shell cores have been made requires no special treatment other than occasional silicone spray. New boxes may be broken in by treatment with a liberal quantity of carnauba wax at 350 to 400° F. Silicone emulsion spray will suffice for subsequent treatment.

Collapsibility and Casting Finish—Collapsibility is excellent for aluminum or gray iron. Casting finish depends on whether the blown core has a hard, smooth surface. Depending on the fineness of sand and the density of the blown core surface, core wash may or may not be required. Tests indicate that casting surface is as good as that obtained with oil sand or shell cores if the surface densities are comparable.

Gas Evolution—A wide variety of castings have been made on a production basis without any difficulty from gas evolution. Furan cores are more permeable than oil-cereal or phenol-formaldehyde cores and they give off less gas, the latter primarily because less organic binder is required. The quantity of gas also may be less because of the composition of gas evolved. Gas from furan cores is evolved somewhat faster than from phenol-formaldehyde cores.

Precautions — Furan resin and catalyst always should be stored separately and used only as directed. The resin should be kept out of any container which may have an acid residue.

During the curing of cores in a hot corebox, some formaldehyde vapor is liberated. Work stations require adequate ventilation.

In the presence of acid or hydrogen ion from any source, furan resins harden. The reaction is rapid and accompanied by evolution of much heat. There is danger if the resin reaction is permitted or caused to take place in a closed container.

Storage—Furan resins have a pH above seven. They are, therefore, slightly alkaline and noncorrosive to iron or steel. They may be shipped in plain steel containers and stored in iron or steel tanks which are clean with respect to acid of any kind. The resin, as shipped, is stable and unreactive at temperatures below the boiling point of water. Room temperature is recommended for storage and some means of agitation or decirculation in the storage tank is recommended if inventory turnover is slow.

Liquid catalysts are shipped in corrosion-resistant containers. They are mildly acid. They have a pH below seven and will cause rusting and corrosion if air also is present in plain iron or steel containers.

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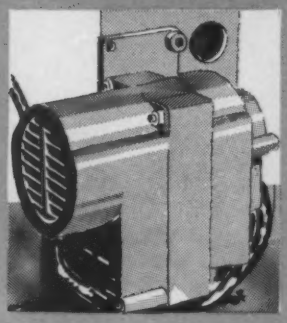

Fig. 1—In research program, mechanical vibrator was bolted to the point on the die where injected metal received initial chill when it contacted the surface of the die cavity

Sound Waves Improve

DIECASTING QUALITY

Sonic and ultrasonic techniques help to expand the application of the diecasting process. Applied properly, vibration procedures also may yield improved mechanical properties and surface finish

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● EXPERIMENTS on the application of sound wave energy to diecasting began about six years ago in this country. Investigations have involved both audible sound waves, in frequencies less than 20,000 cycles per second, and ultrasonic waves, above 20,000 cycles per second. Equipment has been developed to exploit the particular advantages of each, but as of now the audible or sonic approach appears more advanced and may offer greater potential to the diecaster.

History—Highly productive experiments in the application of sound wave techniques to casting processes were performed in 1954 and 1955 by Dr. M. Allen, Massachusetts Institute of Technology, who vibrated permanent molds for test bars 14 in. long and 1 in. square. Dr. Allen discovered that degasification of molten metal through the action of sonic energy occurs at the nodes or still points in the sound wave pattern as it fans out through the liquid metal. The phenomenon causing degasification is known as cavitation and occurs at or close to the nodes. It actually is a rapid generation and collapse of very small bubbles in the metal.

While employed with the Atomic Energy Commission, Dr. J. J. Schrumm also conducted experiments with permanent molds. He used the base of the mold as the vibrating face and zinc diecasting alloy as the metal. His work established the utility of transverse waves to transmit energy into a fluid.

Russian and British scientists also have published papers on the subject, again on work with open permanent molds. They used ferrous and nonferrous alloys and applied vibrating forces directly to molten metal as it filled the mold. Their findings tend to confirm that sonic vibrations are more useful, at least in permanent mold work, than ultrasonic.

Studies by John A. Weber, Southern Die Casting & Engineering Co., have involved vibration of molten metal introduced under pressure into a closed mold so that a correlation with standard diecasting shop practices could be established.

Theory—Foundrymen have agreed generally for many years that if the dendritic or crystalline structure of cast metal somehow could be refined, a denser, stronger casting would be obtained. In a coarse dendritic structure for a solid solution type of alloy, liquid metal has difficulty penetrating narrow channels between the treelike arms of crystalline growth which form during solidification. Voids so formed result in hot tears and microscopic gas inclusions. Even when liquid metal is entrapped in the lattice structure of crystal growth, it contracts on freezing and causes shrinkage porosity.

If, however, by some method the dendritic structure could be broken

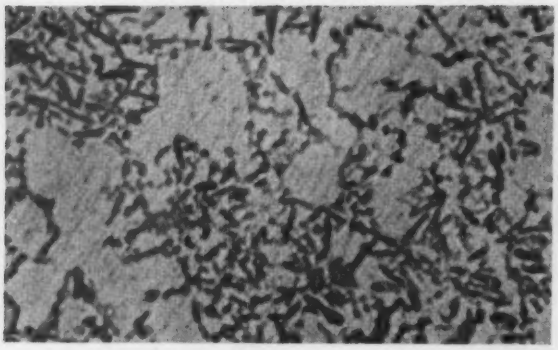
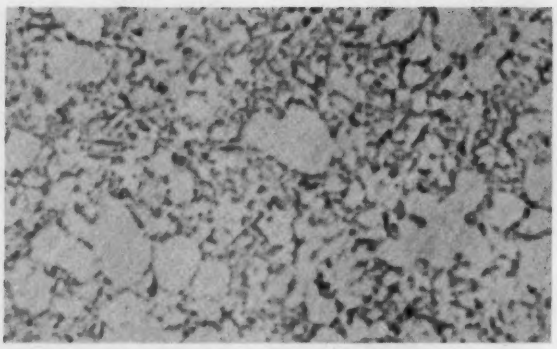


Fig. 2 (left)—Diecasting of secondary 380 aluminum alloy made in normal manner. Fig. 3 (right)—Diecasting of same alloy made with vibration and with die reworked to lead gases out of the cavity



up during solidification and refined in size, there would be ample opportunity for the still molten metal to work its way into and fill completely the minute spaces between adjacent arms of crystals. When the entire mass became a solid, there would be no voids or inclusions, and the casting would have attained maximum density. Moreover, finer segregation of unsolidified metal would lead to quicker over-all solidification.

Such an ideal situation is, of course, possible only in theory. Nevertheless, it has been approached closely by use of vibration techniques.

Research—In the research program at Southern Die Casting & Engineering Co., early studies on production diecasting equipment revealed that sonic vibrations are effective only if applied during the transition of the metal from liquidus to solidus. Therefore a mechanical vibrator of the company's design (Fig. 1) was bolted to the point on the die where the injected metal received its initial chill when it contacted the surface of the die cavity.

When activated at the proper point in the cycle, the vibrator transferred sound wave energy through the die block into the skin of the casting and from there to the molten metal in the center. As waves fanned out from the point of application, they tended to "move" the molten metal to some extent as well as to refine the dendritic structure. The result was better die fill, faster freezing, and a fine-structured, porosity-free casting which followed every detail of the cavity.

Several groups of tests were run on a standard four-cavity test bar mold in a 400-ton cold chamber machine with 380 secondary aluminum alloy. In one series, castings first were run in the normal manner, with die temperature at 650° F. Then, under the same conditions, but with a vibrator attached to the die, a rerun was made. Close examination of cross sections of the vibrated castings under 150X magnification showed the nodes of the waves, where entrapped and dissolved gases were bleeding off because of vibrating action.

Breather lines and overflow vents were channeled into the die face to lead gases out of the cavity. A final group of test bar samples was run on the reworked die with the vibrator in operation for the initial stage of the freezing cycle only. Average increase in density was more than 3 per cent. Under microscopic examination, sections had a much finer grain structure and better element dispersion than the first series and were free of porosity due to gas entrapment. Fig. 2 and 3, of approximately the same casting section, illustrate the findings.

Mechanical testing, verified by independent laboratory check, revealed average values as follows: Ultimate tensile strength, 62,500 psi; yield strength, 34,000 psi; elongation in 2 in., 2 per cent. These readings contrast with the following values in the unvibrated samples: Ultimate tensile strength, 45,000 psi; yield strength, 24,000 psi; elongation, 2.5 per cent.

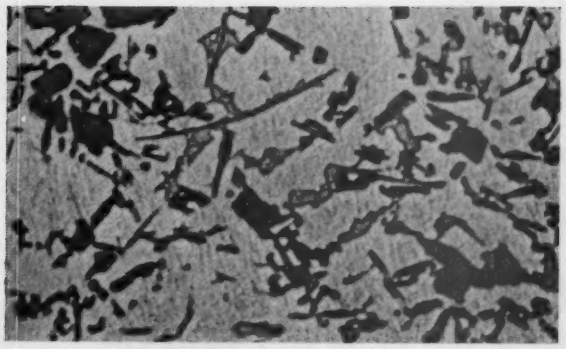
A similar group of tests conducted on 356 primary aluminum alloy with both the permanent mold and diecasting processes indicated similar results. Tensile strength in permanent molded samples improved 40 per cent from 40,000 to 56,200 psi; yield strength increased from 27,000 to 32,000 psi, and elongation dropped from 5 to 3.8 per cent. Fig. 4 and 5 show the marked refinement in crystalline structure.

Diecasting tests using No. 3 zinc alloy revealed a dramatic improvement in surface condition which in one case reduced plating rejects by 20 per cent. The surface skin was thicker and free of metal flow defects, and the castings were appreciably denser.

Practice—A die can be vibrated in the sonic range by mechanical, electrical, or pneumatic means. The unit used in these tests employs the mechanical principle, which has the advantages of long life, low first cost, freedom of maintenance, ease of cooling moving parts, and simplicity of attachment to the die.

Because the essential function of sonic vibrating equipment is to provide a progressive, controlled rate of solidification through the casting and at the same time to drive off entrapped gas by keeping the molten metal in motion, it obviously is necessary to locate the solidification front of the particular casting design as closely as possible. The vibrator then must be attached at the point which will permit sound waves to act through this front and into the unfrozen body of the casting.

Determination of the best location must be made by trial and error, sectioning sample castings to note the effect obtained with different positions. Gradually a sense based on experience is developed which guides the diecasting engineer.



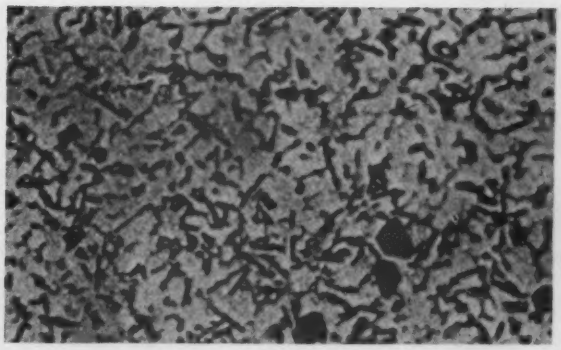


Fig. 4 and 5—Vibration refined structure and increased physical properties of permanent mold and diecastings made of primary 356 aluminum alloy. Microstructure of vibrated casting is on the right

The size and type of sound generator or vibrator determines the frequency capability of the system, and the mounting angle of the unit on the die block establishes the direction of travel of sound waves through the casting. Selection of correct frequency and mounting angle for optimum results again is a trial and error process which eventually gives way to experience. Such factors as size and shape of the die, specific gravity, and temperature of the metal also influence frequency determination.

With sonics, a new approach must be taken to die design. Each die must be engineered carefully to take full advantage of the method. Location of overflows and vents for release of trapped gases is of cardinal importance. Gate designs are affected, too, for with sonics the gate may be opened up and the injection velocity lowered without detriment to surface finish and cavity fill.

For example, a 2¼-lb aluminum casting 24 in. long and only ½ in. thick was vibrated with the gate opened up to 0.120 in. and the injection speed reduced to the machine's minimum setting. More than 10,000 shots were made without a single scrapped casting, whereas the scrap rate had been a prohibitive 30 to 40 per cent.

Subsurface porosity near the gate had been the serious problem, but sonics solved that difficulty. Moreover, cycle time improved, and considerably less erosion on die cavity surfaces occurred because of lower impingement velocity of molten metal.

Ultrasonics—Ultrasonics is a considerably more sophisticated method of application of vibrations to metal during die filling and solidification. Ultrasonic techniques are appreciably more expensive to engineer and apply than sonic methods because of the basic cost of equipment and controls.

The equipment employed delivers more vibration impulses, however, in the restricted time interval between injection and solidification. This factor more than justifies the extra cost in many diecasting applications.

With a problem casting which is difficult to feed without internal shrinkage, ultrasonic procedures can be applied directly to the gate area to increase the feed interval and promote complete filling of the die cavity.

By selecting the proper amplitude and frequency in the ultrasonic range and locating the transducer (a device which transmits electrical power from generator to die block, converting it to mechanical motion) in the area of the runner, the diecaster can disperse entrapped gases into tiny particles which are dissolved by the molten metal. This technique also has the effect of breaking oxide formations into finely divided, harmless particles.

Ultrasonic vibrations applied to cores permit a no-draft core to be withdrawn from a completely solidified casting.

This valuable feature is of particular significance for diecast parts incorporating an internal bearing area in which the surface would be affected detrimentally by reaming or machining. Not only is the bearing area a faithful reproduction of the core's dimensions, but it also has a thick, dense skin with uniformly oriented crystalline structure.

Other advantages also derive from ultrasonic vibratory treatment. One is the discharge of die surface collections onto the casting at each shot. Another is the flexibility of ultrasonic devices in controlling the density of selected sections of the casting.

Drawbacks experienced by users of ultrasonics include fracturing of cores. When a certain resonant frequency and amplitude of vibration are applied to the core, either directly or by vibrating adjacent die components, destructive forces can occur within the core. Soldering also may take place, particularly at the runner and gate areas, because of the scrubbing effect of uncontrolled cavitation in the molten metal. Where nodes in the wave pattern coincide with core and cavity surfaces, the metal sticks to the die and voids form. These apparent limitations can be avoided by proper use of control devices which permit flexibility in altering frequency and amplitude.

Conclusion—Sonic and ultrasonic techniques have been proved useful in expanding the scope of application of the diecasting process. Casting designs heretofore considered impossible now are being produced efficiently by use of correct vibration procedures. When applied properly, these procedures also may yield greatly improved mechanical properties and surface finish. Sonics and ultrasonics must be used, however, in the full knowledge that they are scientific tools, not in an attempt to correct existing faults in die design.

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Modernized Foundry

Builds Business

On Conversions

The addition of new equipment, a modern approach to management, the use of other processing techniques such as coining, and an aggressive effort to convert parts to castings are paying off

By ROBERT H. HERRMANN
Associate Editor

● PRODUCTION CAPACITY of Canton Malleable Iron Co., Canton, Ohio, has been raised to 1000 tons of finished standard and pearlitic malleable iron castings a month. The increased production potential results from a $350,000 modernization and expansion program involving construction of a new melting room and installation of a new cupola, air furnace, an annealing oven, and eight mold conveyor lines.

The modernization was part of a two-part aggressive approach to improving Canton Malleable's business position when that company was bought in February, 1959, by Penn Machine Co., Pittsburgh, Pa. The second part of the approach was a complete reorganization of management to provide a young, progressive-minded group. Concurrently, the sales force was increased. It now is comprised entirely of salesmen with engineering experience. Management believes that salesmen with engineering training or experience create confidence in prospective customers. That belief has been borne out in practice.

When Canton Malleable became a subsidiary of Penn Machine, Penn's president, Richard Wright said, "Our future lies in conversions." The sales force interpreted that as a statement of policy. The sales approach became one of converting forgings, weldments, and stamping assemblies to regular and pearlitic malleable iron.

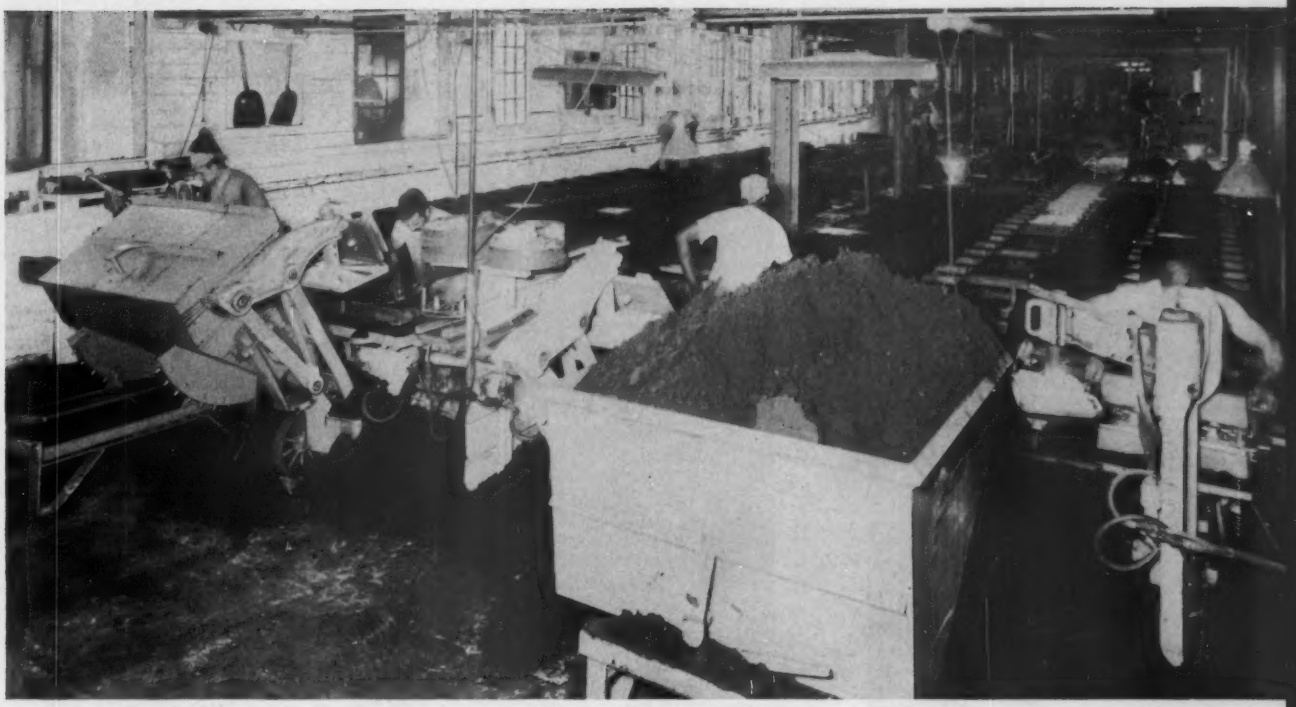
In putting the new sales approach into effect, salesmen met with existing customers in an attempt to get them to order cast malleable parts to replace parts fabricated by other methods. The approach was made on the basis of lower total unit cost accompanied by improved quality and better properties of malleable iron.

Salesmen met with the purchasing people and asked to see the engineers to convince them. Convincing the purchasing agents to use castings was comparatively easy because of the reduced cost possibilities. Customer engineers were more difficult. They had to be convinced that castings could do the job. This is where the engineering backgrounds of the salesmen paid off.

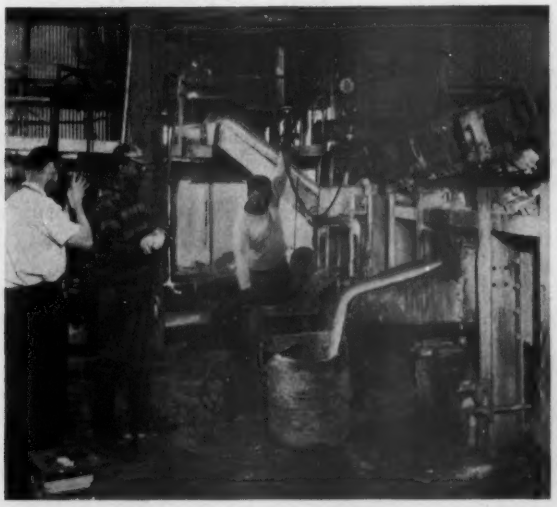
Customers are Co-operative—As the foundry lived up to its promises of lower cost and improved performance, more orders were received for other cast parts. Now, a large percentage of the design assistance in conversions comes from customers. In fact, a number of customers call in a foundry sales engineer for consultation during the design stages of a new part.

Salesmen are backed up by a team of engineering and production people which holds regular "how to" sessions to develop proper design and production techniques. The sessions are attended by heads of the tool and die, pattern, and machine shops, the foundry general foreman and foundry manager, engineering and sales people, and the general plant manager.

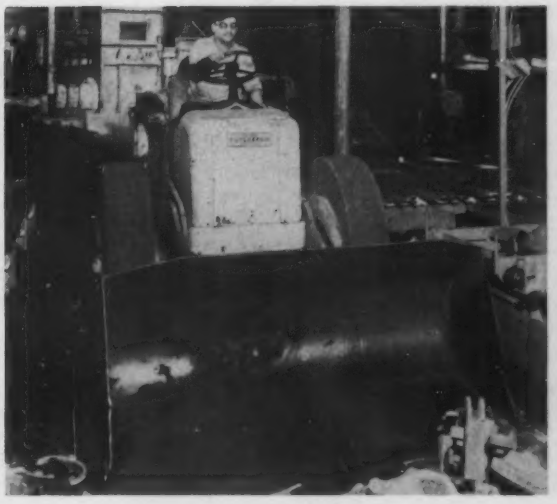
The engineering and production departments have perfected techniques not universally used in foundries to help solve the needs of customers. They include coining and flame hardening. An indexing flame hardening machine was designed and built to provide hard wearing surfaces on mass-produced parts. Consistent 60



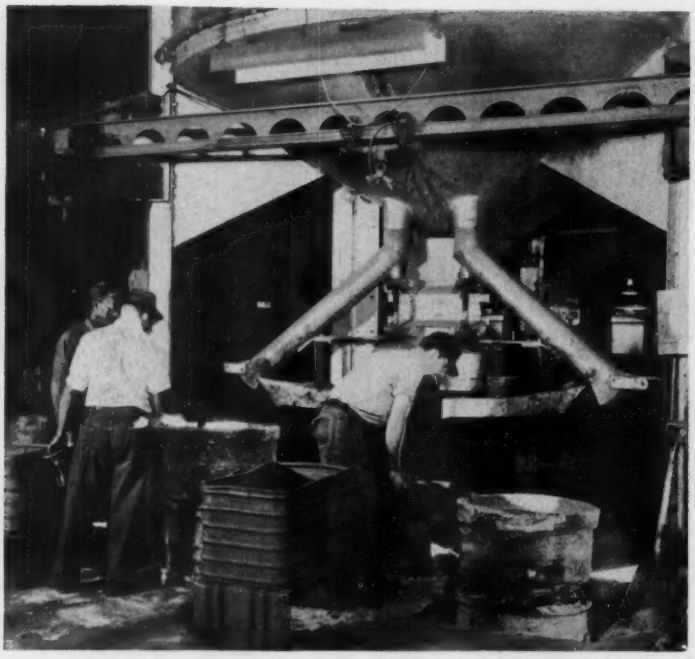
Four of eight new mold-carrying pallet conveyor lines are shown. Jolt-squeeze-strip machines are in foreground. Molds are poured along the conveyors and dumped off the ends. Wheeled pallets, carrying bottom boards, are returned on lower rails



Iron, tapped continuously from front-slagging cupola in background, flows down long trough to the new air furnace at right. Electrically-driven monorail hot metal carriers transport refined iron to mold-pouring areas



Poured molds from the eight pallet conveyor lines are dumped to a central floor area. A front-end loader operator scoops up sand and castings and deposits them on a vibrating, hooded shakeout visible in background



Castings are packed in metal pots with refractory gravel from overhead bins. Compressed air aids flow of gravel from spouts.

Workers along an apron conveyor sort desprued castings into boxes which are trucked to the hard iron inspection area

Rockwell C surfaces have been produced on standard and pearlitic malleable castings.

Customer testing of a flame hardened transmission part provides an interesting example. A competitive forging was wear tested until 0.04 in. of wear was measured. The same tests were performed on a similar, flame hardened, cast pearlitic malleable part. After an equal period in the testing machine, no measurable wear was evident.

The coining of cast parts to close tolerances has helped in the conversion sales effort. Standard and pearlitic malleable iron castings have been coined to a deviation of only 0.003 in. at three points on a casting.

The foundry produces castings ranging in weight from a few ounces to 65 lb for use in over 15 different industries. About 75 per cent of the castings are finish machined in the company's machine shop. Some finished equipment is asembled, packaged, and sold directly by an affiliated company.

Molding Facilities — The eight new mold-carrying pallet conveyor lines are situated in half of a long bay. Two groups of four lines are placed so that molds are dumped at a common central area. Jolt squeeze strip molding machines at the far ends of the conveyors produce molds up to 15 x 26 in. in snap flasks.

Wheeled pallets carrying three or four molds move along the conveyor rails to the pouring area where they are filled from ladles suspended from bridge cranes. Cooled molds are pushed to the end of the conveyors where they rest on a section tilted by a hydraulic cylinder. A worker pushes a button to dump the mold to the floor. The tilting section then tilts back to permit the wheeled pallet, carrying mold bottom boards, to roll to a lower conveyor track where it is returned by an air cylinder pushing device to an air cylinder lift at the molding station. A push of a button actuates both devices, bringing a wheeled pallet with bottom boards to waist level ready to be loaded with another set of molds.

Twenty-five additional molding stations are situated in another bay. They are comprised of ten jolt squeeze machines along opposite walls. Molds are set out on the floor and poured with ladles suspended from bridge cranes traversing the area. Cooled molds are dumped on the floor.

Molding sand is prepared in an automatically cycled muller. Ingredients are weighed or metered, and batches of 3600 lb are prepared in 3½-minute cycles. During the mulling cycle, air is blown through the muller to bring sand temperature below 95° F.

Mixes include 1.5 per cent clay and 0.6 per cent sea coal. Each batch of sand is tested for the desired properties of: Green com-

pressive strength 11 psi, moisture 4.5-5.0, permeability 41-45, and deformation 0.20 in./in. Prepared sand is fork-trucked to molding stations in front-dumping boxes.

Core sand mixes are prepared in a separate muller in an exceptionally orderly and clean core room. Oil-resin sand mixes and resin-coated sand are prepared in the same muller. One type is prepared in the morning. Then the muller is cleaned thoroughly for preparation of the other type in the afternoon.

Coremaking equipment includes blowers for regular sand mixes and semiautomatic equipment for shell cores in addition to several bench stations for core production, cleaning, and assembling. Baking is done in a centrally-situated vertical oven.

Melting—Iron from a skip-hoist-charged, front slagging cupola is tapped continuously at 2740 ° F to a 18-ton capacity air furnace where the temperature of the iron is raised to 2850° F during the refining process. The furnace is fired with powdered coal, and about 600 lb of coal is required to produce 1 ton of refined iron.

Nominal percentage composition of the iron is 2.50 C, 1.05 Si, and 0.40 Mn. Its fluidity is measured at about 20 in. in the standard AFS test spiral. Complete facilities for metal analyses and sand testing are available in a laboratory situated in the molding area. Location of the laboratory room here facilitates the company's quality control program.

Cupola charges consist of 1000 lb sprue, 880 lb steel scrap, 70 lb silvery pig iron, 30 lb spiegeleisen, and 20 lb silicon carbide. Coke splits weigh 190 lb. The original coke bed is built 42 in. above the tuyeres and contains about 1100 lb of coke.

Electrically - propelled monorail hot metal carriers of 1000-lb capacity transport refined iron to mold pouring areas.

Shakeout and Annealing — A worker, manning a front end loader, scoops up dumped molds and deposits them on a vibrating, hooded shakeout situated in the other half of the bay occupied by the mold conveyor set-up. Sand and castings on the shakeout are sprayed with a fine water mist to reduce emission of dust. Shakeout sand is carried by a below-floor-level belt conveyor over a magnetic pulley to a bucket elevator and thence to a storage bin over the muller.

Castings go from the shakeout, which is about 4 ft above the floor, to a hooded, vibrating conveyor. Two men, wielding hammers, desprue the castings on the conveyor. This conveyor discharges to an apron conveyor; workers along each side segregate castings to boxes which are moved by lift trucks to the hard iron quality control inspection center.

Castings passing inspection are annealed in any of four combination coal or gas-fired ovens. These are periodic ovens which permit close adjustment of cycles to meet heat treating requirements of customers.

The standard annealing cycle is 24 hr to bring the castings to 1650° F, 32 hr at that temperature, 12 hr cooling in the ovens to 1400° F, followed by oven cooling to 1300° F in 26 hr. Then the ovens are opened, and unloading with fork lift trucks begins.

Castings are prepared for annealing by packing in metal pots with gravel and granulated refractory for support to prevent warping of complex castings. In some cases the packing material is pea size carbon coke. Packing materials are stored in overhead bins with hand-operated gates at the bottoms. Air at 90 psi is blown into the tops of the bins to aid flow of the material out the gates and into the pots as work-

Electrically propelled monorail buckets carry heat-treated castings to benches in the soft iron inspection department

Pots of castings to be annealed are stacked three high on a metal stool and moved into an annealing oven by fork truck

ers properly position the castings.

Pots are packed three high on pneumatic lowering devices under the packing material gates. The joints between them are sealed with refractory mud. Then they are fork-trucked into the ovens. After the annealing period the truck operator removes the pots from the ovens to air clamps in a vented enclosure.

As the truck removes the bottom stool from the stack, the contents fall to a vibrating screen. The packing material is elevated to the storage bins at the packing station. Castings go off the screen to a bucket lowered to basement level by an electrically-propelled hoist which operates on an overhead monorail.

Filled buckets are lifted to ceiling level of the first floor and moved over sorting tables and automatically tipped to dump the castings. Fins and stubs are ground off the castings at three double-end stand grinders. After grinding, castings are transported directly to soft iron inspection or, in the case of pearlitic malleable iron parts, to small gas-fired heat treat ovens.

The treatment here consists of 20 minutes at 1600° F followed by a high temperature oil quench for 8 minutes. Castings then are air cooled. Variations in air cooling and in the draw permit obtaining a wide range of Brinell hardnesses. Heat treated castings are loaded into boxes and automatically transported by monorail carriers to the soft iron inspection department. Limit switches stop the carriers at the desired bench in a row of benches, and the castings are dumped.

Finishing Treatments—Inspectors segregate the castings into boxes for trucking to flame hardening equipment, the machine shop, or to presses for shearing, straightening, or coining. A large percentage of the castings are coined. As discussed earlier, the company believes that the cast-coining operation has improved its competitive position in the market.

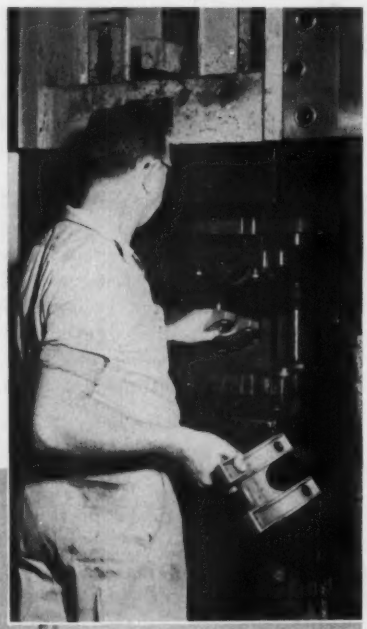
The same group of five mechanical and hydraulic presses used for coining, ranging in capacity from 75 to 500 tons, is used to punch and form from blank stock parts used in assembled components produced by the company.

Flame hardening is done in a specially-designed four-station rotary machine. A blend of oxygen and acetylene is fed to the machine from outside storage tanks. Castings are loaded by hand to spring-loaded holders at the first station. Burner flames are directed to desired spots on the casting at the second station. Water jets are directed at those spots at the third station. At the fourth station the castings are ejected automatically to an oil quench tank.

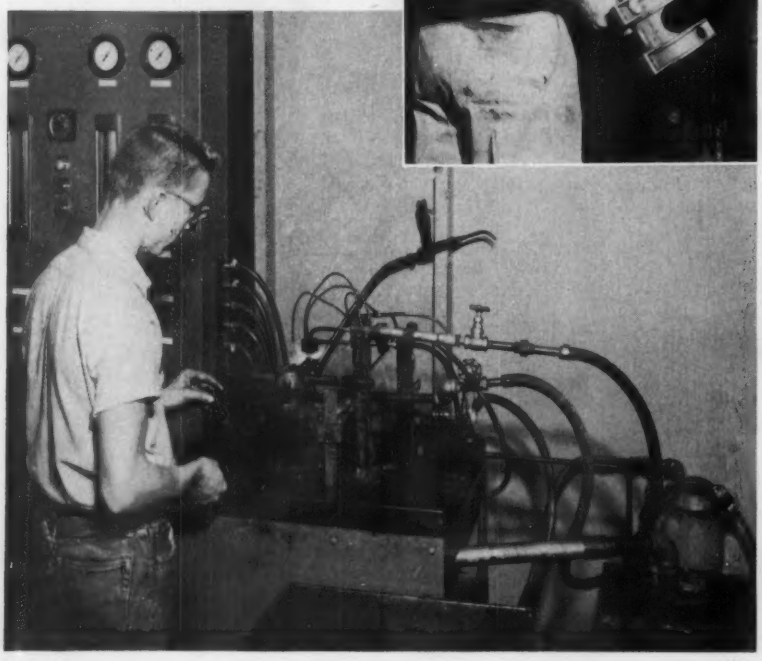
The operating cycle varies for different parts. In the case of a shifting fork for an automotive transmission the cycle is 6 seconds. The treatment provides hardnesses up to 60 Rockwell C in the skin of a casting which retains a tough core of standard or pearlitic iron.

Castings which have received the prescribed finishing treatments are moved to the shipping department where they receive a final quality control inspection which is the same as the customer's inspection upon receipt of the castings. It involves dimensional checks by gages and fixtures and visual observations of surface conditions.

About 40 per cent of the castings are packed on pallets with corrugated paper sides, 25 per cent are shipped in corrugated paper cartons, 25 per cent go in collapsible wire boxes, and 10 per cent are shipped in burlap bags. Shipments are made in company or commercial trucks or in railroad cars.



Many castings, this two-piece bearing cap being one, are subjected to a coining operation. The company believes that the sale of cast-coined parts has made it more competitive



Flame hardening of castings to provide hard wearing surfaces also has raised the company's competitive position. This indexing machine hardens parts in an average of six seconds

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By W. P. WINTER
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Hold That Temper!

Moisture affects almost every property of molding sand. In this article, the fourth in a series of six on foundry sand, the author explains the nature and causes of the effects of moisture content

● SO MUCH has been written about moisture content of molding sand that new articles seem almost like "needless repetition." They may be repetition but they certainly are *not* needless.

Moisture, often called a necessary evil, affects almost every property of molding sand. The fundamental problem includes maintaining correct moisture levels during the day as well as from day to day. Foundries can encounter a change of casting quality from hour to hour just as much as from day to day and, of all possible causes, moisture content is the most important. Moisture changes the major properties so drastically that it is without doubt the first line for sand temper control. The foundryman must hold that temper!

The word "temper" can be defined as the adding of one substance to another for the purpose of altering properties. Adding water to molding sand is, by this definition, a tempering process, and molding sand properly moistened is said to be tempered. Sand is correctly tempered when it contains just enough moisture to render the clay plastic. This promotes coating of the sand grains and produces a useful level of properties.

A correctly tempered molding sand will have properties at the best level for the particular work being done with that sand. Other molding sands may temper at a vastly different moisture level and yet be suitable in a different application. The total problem is one of determining the correct temper for the sand in use and controlling it to hold that temper.

Much of the more recently published material is based on studies centered around finding an explanation for the tempering phenomena. Such studies have proved valuable but it is not the intention here to evaluate them. Our objective is to tell a simplified story of observed facts and by so doing provide a ready reference.

Major Components — Water is one of the three major components of molding sand. The others are the sand grains, which constitute the bulk of the aggregate, and the clay substance. Additions of water tend to develop the bonding effect of the clay. When molding sand is tempered, the plastic condition imparted to the clay creates conditions that are, in turn, imparted to the entire mass.

Writers often provide a partial explanation for some of the action of added water by thinking of the total moisture as occurring in several forms. *Combined water, free water,* and *temper water* are terms frequently used. Most authorities agree that in a clay-water system, water may be present as (1) combined water or water of crystallization, (2) *ab*sorbed water or that which migrates within the crystal lattice structure of a particle, (3) *ad*sorbed water or the water that is held on the surface of particles, and (4) free water or the water that permeates the mass by means of capillary action.

The exact chemical, physical, or electrochemical theory is not important here. It can be reasonably assumed that water of crystallization is neither controllable nor of major importance in molding sand problems. At the other extreme, the free water as defined above serves only to flood the mass and is obviously not a factor in true tempering action. It is the water that is absorbed and adsorbed that makes up the true temper water of molding sands.

An excess of temper water is called tempering on the heavy or wet side. Lesser amounts than optimum is to temper on the light or dry side. Excessive water, even within the control range, may sometimes be liberated at an explosive rate when a mold is poured. Most instances of molds exploding are accidental conditions of free water in the molding sand mass.

Sand control tests for moisture will provide the measure of temper and free water. Other procedures can be used to test for other major properties. Such tests, when properly studied and related, give the foundryman a useful evaluation of his molding sand and thus a control of his product. Many common foundry problems are associated with moisture and moisture control.

Influencing Factors — Moisture content in molding sand is not arbitrary but is dependent on many factors. These factors include the type and amount of clay present since different amounts of clay naturally will require different amounts of water for correct temper. It is also important to understand that

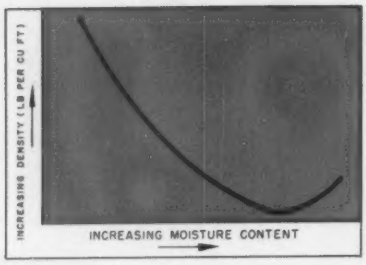

Fig. 1—Bulk density vs. moisture content. Curve's minimum corresponds to correct temper

different types of clay will temper at different moisture ratios.

In general, the type and amount of clay that reaches optimum plasticity with minimum amounts of temper water per pound will give a minimum amount of trouble in the foundry. Although clay is more directly concerned, sand grain fineness, the type and amount of any special purpose additives (such as wood flour and sea coal), sand grain distribution, and other factors help determine the correct temper for any given molding sand.

As these factors are studied, most of the properties of the sand are seen to be changed drastically. Among the more important properties affected are bulk density; green strength measured in compression, tensile, or shear; dry strength also measured in compression, tensile, or shear; permeability, the measure of porosity; deformation; toughness; flowability; and others. The effects of moisture on these properties can be shown graphically. The accompanying curves are generalizations based on many observations—thus eliminating the specific conditions of one particular molding sand.

It must, of course, be understood that a natural sand will require somewhat higher moisture content to provide anything near the properties of most synthetic molding sands. The investigation of a new molding sand must include properties measured at enough different moisture content levels to fully evaluate the conditions. The relative quality of any molding sand cannot necessarily be based on a single moisture content.

Bulk Density—The initial effect of moisture in molding sand is the effect it has on bulk density. An old foundry rule-of-thumb called for the molder to squeeze a handful of the molding sand. If the resultant mass felt light in weight, retained sharp edges, and could be judged on a few other counts, it was supposed to be properly tempered. Although this method seems inaccurate and must be gained by experience rather than learned in demonstration, it actually has some scientific basis.

As water is added to sand in relatively small amounts, the bulk density decreases steadily until a low point is reached. Further additions create an increase in bulk density. This minimum weight per unit volume occurs at or very near correct temper and accounts for the feeling of lightness of the handful of squeezed sand. Fig. 1 illustrates this fundamental condition.

Strength — The strength of a molding sand bonded with moist clay is usually taken to mean green compression strength. If another strength measurement is intended, it would be specified as green or dry tensile, green or dry shear, or green or dry transverse strength. These strengths are measured in common terms, usually pounds per square inch or ounces per square inch, by using a standard specimen as specified by AFS. If the specimen is first dried at approximately 220° F for two hours before testing, the value is known as dry strength; if tested in the moist condition the value is known as green strength.

Both green and dry strength are affected by the moisture content of the molding sand in question. Fig. 2 illustrates some typical strength variations. It can be seen that green compression strength increases with increasing moisture until an optimum level is reached. Water additions beyond this point generally cause a decrease in strength. Although it cannot be shown on this curve, the optimum strength of most molding sands occurs just prior to correct temper as determined by the bulk density curve.

It is also important to realize that molding sands tend to be brittle and hard to patch when they are at the high point on the strength curve. For this reason they are usually carried on the wet side of the green compression strength curve. Unlike green strength, dry strength increases rapidly as moisture content is increased.

Permeability—This is a measure of the freedom with which the molding sand mixture permits gases to pass through it. It is determined as rate of flow of air under pressure through an AFS sand specimen. The permeability value is highest when the bonding clay has absorbed that amount of water which will impart maximum stiffness to the clay particles. In this condition the sand grains are held farthest apart after ramming (Fig. 2). This property is directly related to the correct temper of the molding sand since it occurs at or very near the same moisture content that is observed to produce the lowest bulk density for the sand under study.

For many molding sands a simplified but reasonable control can be effected by studying only the green compression strength and permeability, since other properties often will fall into line with these two. A full study, however, requires the consideration of other properties.

Deformation and Toughness—During the testing for green compression strength of a molding sand, the extent of change before failure of the specimen can be observed and measured. This is called deformation and serves as a measure of the dependability of a mold made with the sand. The degree of plasticity, judged by the hand-feel test of past years, is a matter of green deformation. As moisture content increases, green deformation also increases and sand tempered on the heavy side will more likely permit swelling which results in oversize

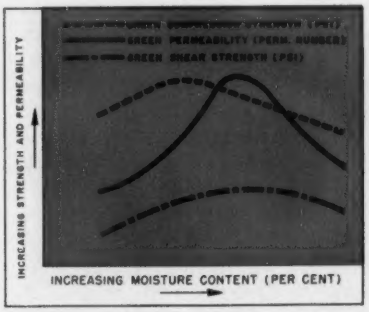

Fig. 2—Curves show effect of moisture content on three important properties of sand

castings. A typical deformation curve is shown in Fig. 3. Determination of green deformation along with other factors provides a good way to find correct temper.

When studying deformation, the amount of work necessary to break the specimen can be measured. This is known as the toughness of the molding sand. Deformation times green compression strength times 1000 gives the sand toughness number (STN). (A typical toughness curve is included in Fig. 3.) Toughness increases rapidly with moisture within common and practical working limits.

Correct temper will provide good toughness in a molding sand and the combination of these properties means good workability. With deformation and toughness under control due to careful practice in the addition of water, a standardization of the degree of ramming can be established, resulting in molds of controlled green hardness and uniformity.

Flowability—This term generally refers to the movement of sand grains when they are acted upon by molding forces. A continuous mold surface with a minimum of voids generally is desirable. The ease with which this condition can be created is a function of flowability. As can be seen in Fig. 3, flowability decreases slightly with the initial increase of moisture but then increases. The lowest value for flowability is apt to occur very near correct temper since at this moisture content the clay is stiffest.

Excessive toughness and lower flowability likely will occur when one of the following conditions exists: High moisture, high strength, or high deformation.

Mechanics of Moisture Control—The man with the sprinkling can or hose, wetting down his molding sand by trial and error, rapidly is becoming a thing of the past. As more is learned about the moisture content problem, greater effort is required to predict accurately the moisture needed and accurately measure the moisture used. The day of trial and error is going out along with the "art" of molding. More scientific thinking must and is being applied.

Initial evidences of more accurate control of moisture came with the several improved methods for determining moisture content rapidly. It is not satisfactory to take minutes to discover that the moisture is incorrect when during that lapse of time many tons of molding sand may have been used.

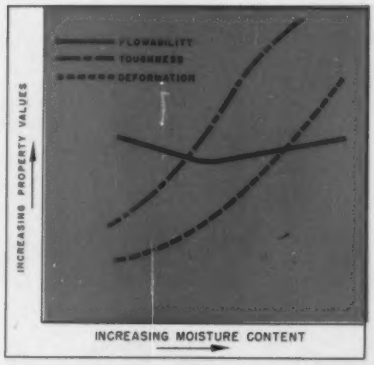

Fig. 3 — Toughness, deformation increase with moisture content, but flowability changes little

Mechanized systems for mixing, aerating and moving sand are now in common use. To take advantage of the savings that can be gained from use of such equipment, instantaneous moisture determinations are required.

Devices for instantaneous moisture determination are based on the electrical characteristics of the sand. In some cases the conductivity of the sand provides a means for measuring the degree of moisture, and in others the capacitance of the sand provides the measure. Since the electrical resistance, and hence conductivity, does not increase at a uniform rate and is more likely to be affected by grain fineness, organic additives, and other factors, the use of electrical capacitance generally is more acceptable.

A continuous moisture measuring and recording device of this type can be mounted near the conveyor to provide a constant check. An operator can watch the recorder, or the device can be enlarged to operate relays and control valves automatically, thus insuring proper moisture control without delay.

Such devices may prove to be quite expensive for many installations. When other methods fail to provide a solution, the automatic equipment frequently proves to be economically sound. Reduction of defects and improved casting production often are due entirely to proper moisture control.

Predicting Requirements — Several attempts have been made to develop an accurate method of predicting moisture requirements of molding sands. The idea centers around measuring the moisture on the basis of the known ingredients in the sand. Water needed to wet the sand grains—water needed to satisfy the needs of the clay bond—and water needed to wet other additives such as wood flour, sea coal, cereal, etc. is reportedly standardized. The water required by the sand has been shown to be directly related to the AFS grain fineness number, and tables have been developed to give a quick answer. Such quantitative predictions could have far reaching results but certain less controllable variables tend to reduce the effectiveness of this approach. More work along these lines might well be done.

Although no foolproof method has been developed, a more recent contribution offers several empirical methods for predicting the moisture required in a complex molding sand mixture. One of these methods is based on deformation readings of prepared samples, values which may be not fully dependable. It also can be used only on certain types of molding sand mixes and in cases where fines are below a certain level.

Requires Extensive Data

Another fairly new method requires quite extensive data including AFS grain fineness number, screen distribution, amount of total combustibles, and other data. With this information the moisture requirements for the sand in question can be calculated.

Although this sort of empirical approach has much in its favor, the practical foundryman may find it more expedient to proceed by determinations of green strength, permeability, and other more common properties. Once he finds the best moisture content based on this study, he needs only take steps to see that this moisture level is controlled within reasonable upper and lower limits. To do this his sand must start at a known level. Then he makes accurately weighed or measured additions of water, periodically tests water content at intervals in keeping with his needs.

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GATING

Magnesium Sand Castings

Proper gating practice is important in casting magnesium because of the high strength-weight ratios usually required. Gating for achievement of optimum properties is outlined in this article

● BASIC PRINCIPLES of gating and risering, applicable to the design of a gating system for all cast metals, were reviewed in earlier articles[1,2]. The optimum gating practice for a specific cast material is established by the extent or degree to which the different factors involved influence quality or cost.

The purpose of this article is to outline the optimum gating and risering practice for magnesium sand casting alloys. For continuity and clarity, many of the items covered in the earlier articles will have to be incorporated. However, only where the practices recommended for magnesium alloy sand castings differ or where extensive use is made of a specific procedure will the items previously mentioned be discussed in detail.

Most magnesium alloy sand castings produced are used in the aircraft industry as integral parts of a plane, missile, or accessory equipment. In almost every case where magnesium is employed, the engineer desires to obtain a high strength-weight ratio.

Because of cost considerations, magnesium alloys usually are utilized after the designer has determined that other materials are too heavy or do not have the physical properties necessary for the application. By that time, the safety factor has been reduced to a minimum. As a result, no compromise that would adversely affect the quality can be made in rigging. Because of the low heat content of liquid magnesium, its low specific gravity, and its high chemical reactivity, magnesium alloys are more difficult to cast than most other commercial alloys.

Gating of Castings—Considerable work has been done in studying flow conditions and behavior of molten metal in molds. Formulas have been developed and principles proposed that have been of material aid to the foundry. The formulas and principles can be used as a guide, but they will not apply to all metals to the same degree or to any one metal under all conditions. In all cases, good judgment and experience are needed.

When molten magnesium is exposed to air, it oxidizes more rapidly than other commercial casting alloys. Turbulence anywhere in the mold will cause mixing of mold gases with liquid metal and will produce oxide films. Inhibitors that form protective films on the metal surface are employed in molding sands for magnesium alloys.

However, if the protective film is stirred into the liquid metal by turbulent flow, additional films will be formed and the liquid metal entering the casting cavity will contain oxide and possibly unreacted mold gases. Dross inclusions in the casting theoretically can be prevented by two methods:

1. Avoiding all turbulent flow of metal from the pouring crucible to the casting cavity.

2. Removing dross from the molten metal before it enters the casting cavity.

Work of Elliott and Mezoff[3,4] and an American Foundryman's Society sponsored research project[5,6,7] conducted at Battelle Memorial Institute disclosed how gating conditions could cause mold gases to be aspirated into the metal stream. Methods of eliminating the entrainment also were investigated.

Principles were advanced that could be expected to minimize the quality of dross formed, but, to date, no one has proposed a design for a gating system that could assure dross-free metal to the casting cavity by eliminating turbulent flow.

In magnesium foundries, entrained dross is separated from liquid metal by perforated metal screens. It is expected that turbulence in the first parts of the gating system will generate dross, but this can be separated from the liquid before it enters the casting cavity. However, the metal can not be jetted into the casting cavity at the ingates or cascaded from a higher to a lower level without forming oxide.

Molten metal should enter the casting cavity at its lowest level and the cavity should be filled progressively upward. With these basic principles in mind, let us now consider in detail the various parts of the gating system.

Pouring Basin — Although considerable work has been done in research projects[4,6,7,9] to determine the best possible pouring basin design, it is the author's belief that the design of the pouring basin is not critical. The size of the pouring basin is governed by the size of the casting. Larger castings require

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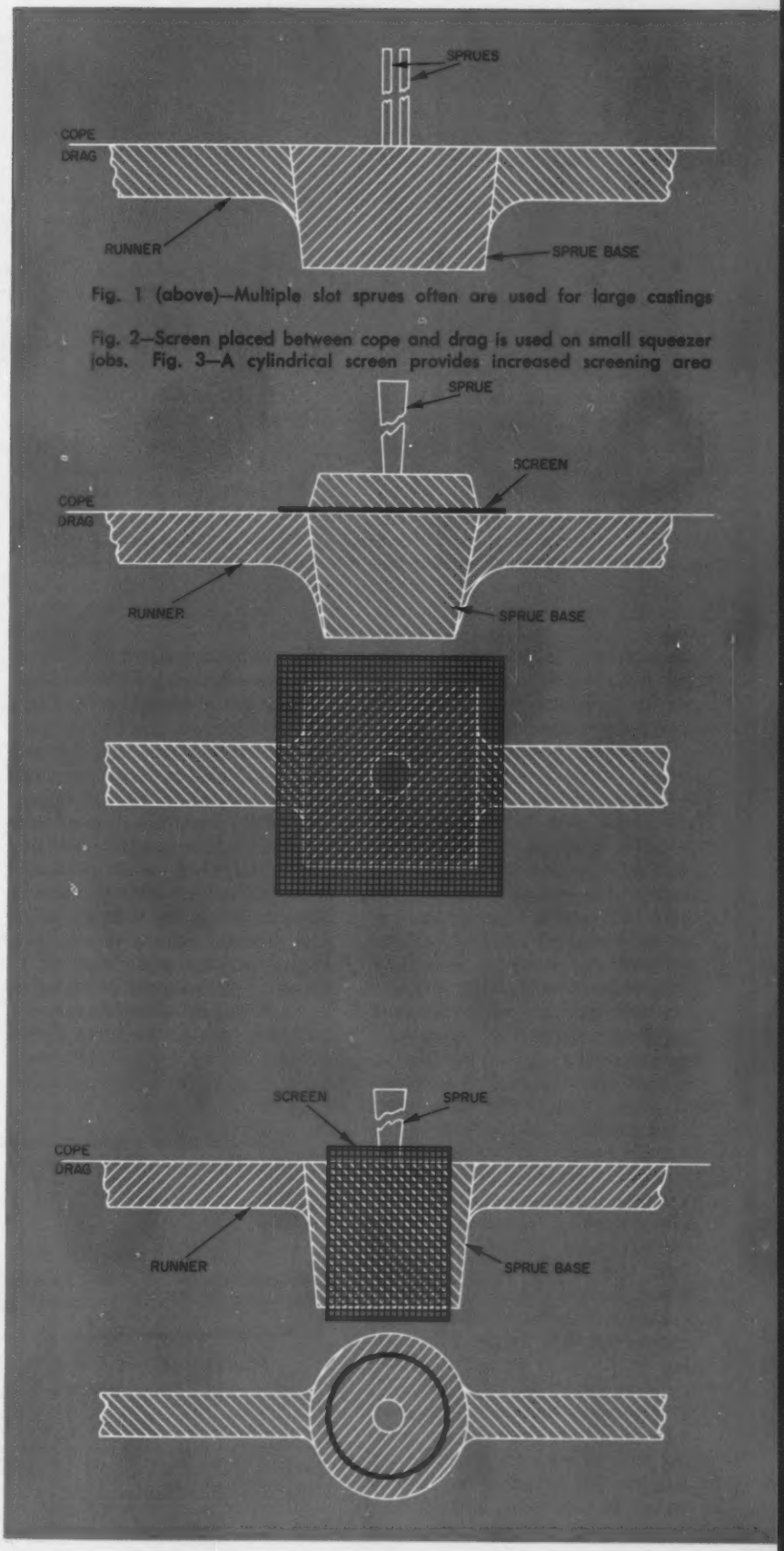


Fig. 1 (above)—Multiple slot sprues often are used for large castings

Fig. 2—Screen placed between cope and drag is used on small squeezer jobs. Fig. 3—A cylindrical screen provides increased screening area

larger pouring basins. If thin wall castings are to be produced, a large pouring basin will aid in eliminating misruns because of the increase in the pressure head.

In every case, the basin must be large enough to permit the pouring crew to fill the sprue quickly and thus minimize the volume of air entrained in the vortex. A cast or fabricated iron box with wedge-shaped lower edges that can be pressed into a green sand mold is satisfactory for this purpose.

Sprue—The pouring rate should be regulated by the size of the sprue. The runner and ingates are made large enough to offer little resistance to the metal delivered by the sprue. Whenever possible, the metal should drop to the lowest position in the mold through the sprue.

Elliott and Mezoff[3] disclosed that slot-type sprues with a large ratio of perimeter to area do not aspirate mold gases even though the sprues were not tapered. To explain this, they theorized that the major resistance to flow of the sidewalls became significant when the cross-section of the sprue had a high ratio of perimeter to area. It also has been proved that slot sprues will remove some dross from the liquid metal.

To obtain a satisfactory flow rate, at least for large castings, more than one slot sprue has to be employed in a manner shown in Fig. 1. This presents a molding problem. Ramming the sand between the two slot patterns is difficult. Usually the sand is loosely packed between

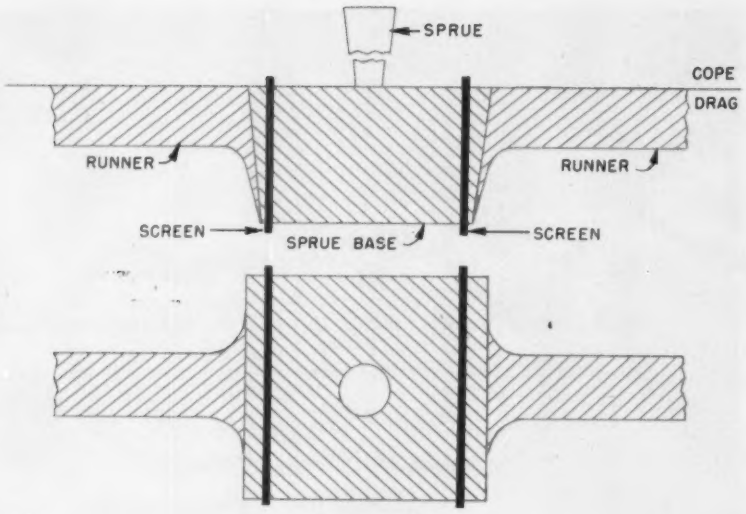


Fig. 4—Two screens, placed vertically in the sprue base, provide more area than horizontal screens and are cheaper than cylindrical screens

the slots and it has a tendency to fall out. If this occurs when the pattern is drawn, the cope can be scrapped or repaired.

If sand drops when the casting is being poured, it might be enclosed by liquid metal. A substantial quantity of gas then will be produced. It could appear as worm holes in the side of the casting or as sponge porosity in localized areas. By the time the casting is inspected, the runner and sprue usually have been removed. As a result, either the melting practice, or gating and risering techniques are suspect for causing the porosity rather than foundry workmanship.

Until the AFS film on principles of gating was viewed, slot sprues were employed exclusively in the writer's foundry. However, the reduction in molding problems plus a substantial decrease in previously unexplainable, extremely porous castings have justified converting from slot sprues to large-end-up, round, tapered sprues.

Design of the large-end-up, round, tapered sprue is simple. The opening at the sprue bottom should be sized to permit sufficient metal to flow through the opening to avoid misruns at a reasonably low pouring temperature. There is a general tendency to employ too large a sprue. In that case, quantities of dross causing folds or surface flow lines will be formed. In many cases, these are too small to be seen visually, but are disclosed in a Zyglo examination.

If the sprue is too small, the castings will have misruns, but these can be detected by a rough inspection and corrected before very many castings are poured. The taper of the large-end-up sprue should be such that the flow of metal is restricted at the sprue bottom. The area at the top of the sprue is usually about three times that of the bottom. A round sprue is the easiest to mold and gives satisfactory results. The top of the sprue should be reamed and blended into the cope surface to provide smooth flow from the pouring basin.

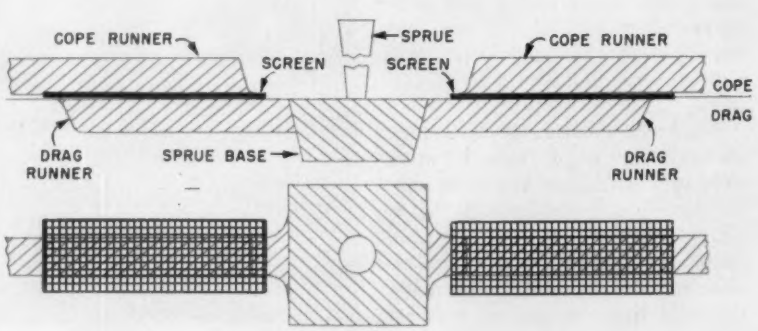
The sprue should be located away from riser openings. This allows flexibility in the size of the pouring basin that can be utilized. Compared to other commercial alloys more numerous and more closely spaced risers have to be employed to produce a sound magnesium alloy casting, because of its comparatively poor feeding characteristics.

Castings can be lost for a defect called "metal down the riser" if the sprue is too close to an open riser. This can occur as a result of metal splashing over the pouring basin and down the riser or by metal flowing under the pouring basin and down the riser. A thick oxide film will separate the metal that drops into the casting cavity from the metal which enters the cavity through the ingates.

Sprue Base—The sprue base is an enlargement at the bottom of the sprue and is employed to reduce turbulence that occurs in changing the direction of flow from vertical to horizontal. The sprue base can be round or rectangular. Depth of the rectangular sprue base should be $1\frac{1}{2}$ to 2 times the runner depth, and the length should be about 4 times the sprue diameter. The cylindrical sprue base should be large enough to accommodate the screening necessary. With magnesium base alloys, screening of the metal stream usually takes place in the region of or adjacent to the sprue base.

Screening Practices—Screens are

Fig. 5—Horizontal screens at overlap between cope and drag runners provide effective screening. This is probably the most effective method



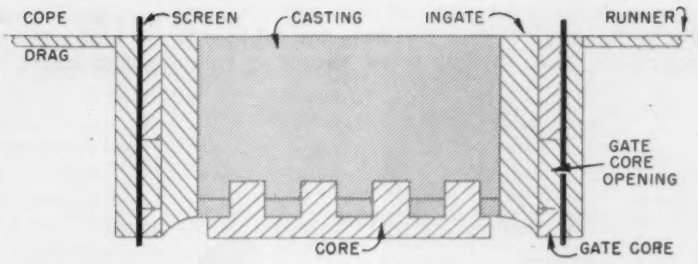


Fig. 6—Vertical screens are used here in conjunction with gate cores. Metal drops beside the gate core and is screened before entering cavity

of perforated, tin-plated sheet steel. Screens, approximately 0.010 in. thick, with various diameters of perforations, spacing, and percentages of void areas, may be employed. They filter out oxide inclusions and tend to smooth out metal flow. Fig. 2 illustrates a simple screening arrangement that has been utilized successfully on small squeezer jobs.

The horizontal screen between the cope and drag section will absorb the kinetic energy of the metal coming down into the mold and aid the tapered sprue in minimizing turbulence. This arrangement provides a limited screening area. If the casting being poured is massive and a fairly large volume of metal is poured, the oxide and dross will plug the holes in the screen causing misruns in the castings.

In some cases, the pressure of the molten metal falling on the screen will break the oxide films and force them through the perforations into the casting cavity. As a result, an inferior part will be produced.

The amount of dross that will be forced through the screen openings can be reduced by using a cylindrical, vertical screen at the sprue base as shown in Fig. 3. This cylindrical screen will require no more mold space than the horizontal screen, but it will provide increased screening area and thus will minimize the problem of misruns caused by dross-clogged screen openings. Since less pressure will be exerted to force the dross through the vertical screen, somewhat cleaner metal will result. Cylindrical screens are more expensive to make and take more time and equipment to produce than flat screens.

If plant facilities are not available for making cylindrical screens and if the amount of metal to be poured cannot be cleaned by a horizontal flat screen, vertical flat screens merit consideration. As shown in Fig. 4, two screens are used in the sprue base. In this case, the size of the sprue base is determined by the screen openings. The area of the runner should be four times the area of the bottom of the tapered sprue, and the open area of the screen should be large enough to fulfill this requirement.

Screens with 25 and 50 per cent open area can be obtained. The screen will have a tendency to become clogged with dross. For this reason the open screen area should be five rather than four times the area of the sprue bottom. The above factors control the width of the sprue base when vertical flat screens are employed. In molding, the screens are inserted in slots in the pattern. During a high production cycle, the screens are not always set all the way down in the slots. As a result, the metal will run over rather than through the screens and the casting will contain excessive dross.

A horizontal screen at the overlap between a cope and drag runner, as illustrated in Fig. 5, is a very effective means of screening the metal. Technically, this is probably the best method of all discussed, because the kinetic energy is absorbed in the sprue base and the metal rises quietly in the drag runner through the screen without a jetting action.

In all previous examples of screening practices, the first metal passing through the screen would be, in effect, sprayed through the screen in the form of small threadlike streams. Dross is formed until the reservoirs on both sides of the screen are full. Then the metal flows quietly into the horizontal runner. Although screening at the overlap is the most desirable procedure from a metallurgical standpoint, it has its production problems.

To provide adequate screening area, a 2 to 4-in.-larger flask size must be used than is necessary with the other screening practices. Fewer castings will be obtained from the pattern in an 8 hr shift with the larger flask. Furthermore, the flask size will govern the size molding machine to be used. So, production control and process yield are factors in the establishment of the screening practice to be employed.

Special Screening Practice—Spe-

Fig. 7a—Ingate enters piston riser. If this setup is used, some shrinkage can be expected at the interface of the wheel casting and the riser

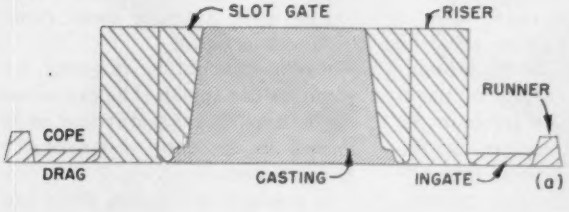


Fig. 7b—Remedy for this shrinkage problem is to place a tubular screen in the riser. When a screen is used, the mold is filled by layers of hot metal

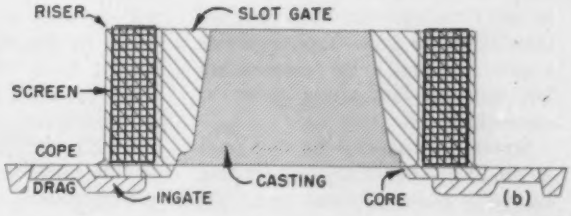
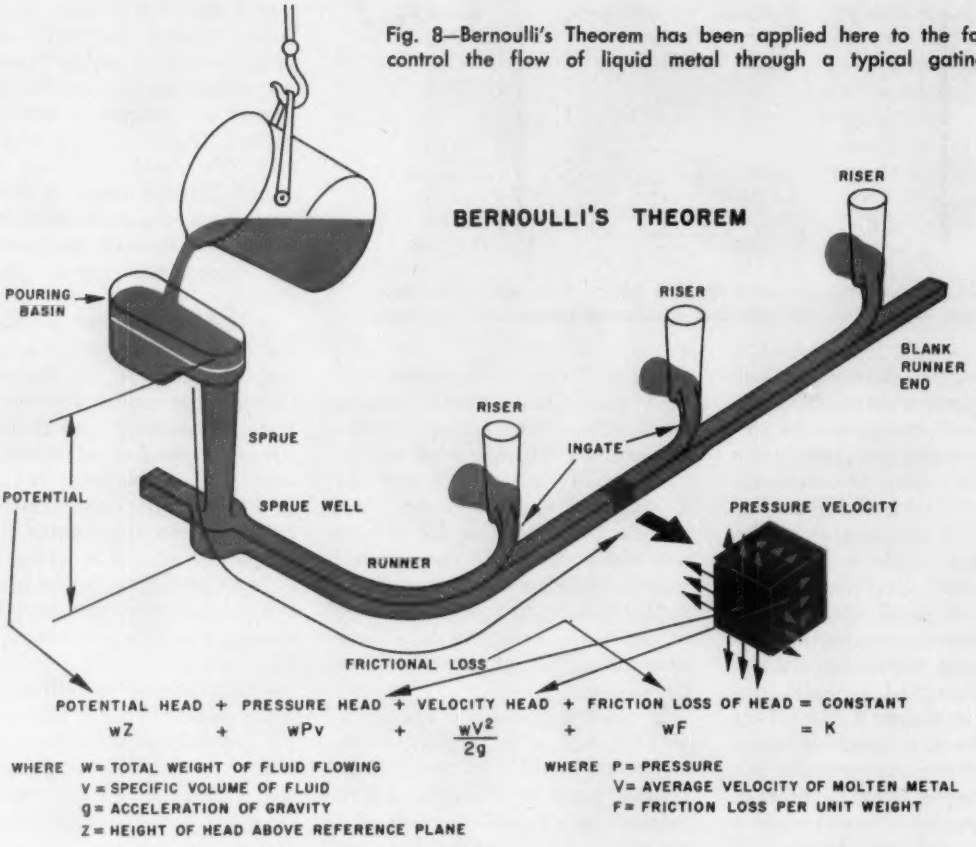


Fig. 8—Bernoulli's Theorem has been applied here to the factors that control the flow of liquid metal through a typical gating system[1]


BERNOULLI'S THEOREM
POURING BASIN
SPRUE
POTENTIAL
SPRUE WELL
RUNNER
RISER
INGATE
RISER
RISER
BLANK RUNNER END
PRESSURE VELOCITY
FRICTIONAL LOSS
POTENTIAL HEAD + PRESSURE HEAD + VELOCITY HEAD + FRICTION LOSS OF HEAD = CONSTANT
wZ + wPv + wV²/2g + wF = K
WHERE W = TOTAL WEIGHT OF FLUID FLOWING
V = SPECIFIC VOLUME OF FLUID
g = ACCELERATION OF GRAVITY
Z = HEIGHT OF HEAD ABOVE REFERENCE PLANE
WHERE P = PRESSURE
V = AVERAGE VELOCITY OF MOLTEN METAL
F = FRICTION LOSS PER UNIT WEIGHT

cial screening techniques may be required for certain castings. A few special techniques merit comment.

To insure that dross inclusions do not form in the casting cavity, the metal must not be allowed to drop from one level to a lower level within the cavity. This rule suggests that the casting be molded in the cope. However, when cores have to be used, they are set in the drag to minimize dimensional problems. Furthermore, substantial savings can be had by molding a large part of a deep casting in the drag and filling the castings from the parting line. In such cases, the metal can not drop to the lowest level in the sprue, and the metal would be excessively drossed if permitted to fall into the casting cavity. One method of circumventing this problem is to allow the metal to drop beside a gate core and to be screened before it enters the casting cavity, as shown in Fig. 6.

Screening also can be employed to produce a desirable flow pattern. In many cases, a piston-type riser with a slot ingate is necessary to eliminate shrinkage in the casting. However, preferential flow paths are known to form and the metal does not flow progressively from the top of the piston riser through the slot gate. In Fig. 7A, the molten metal enters the wheel casting through two piston risers. When this procedure is employed, a line of microshrinkage usually will form in the casting under the slot ingate. This condition is attributed to the fact that preferential flow paths are established early in the pour, and the sand is overheated in localized areas.

Incorporation of a tubular screen, as shown in Fig. 7B, will eliminate the shrinkage under the riser by producing a desirable filling pattern. Addition of the tubular screen will produce a horizontal flow of metal in the slot gate so that the casting cavity is filled by substantially sucessive layers of hot metal at progressively higher levels in the casting cavity. Furthermore, the riser fills with metal directly from the gating system. With this practice, there is no drop of metal in the casting cavity and the best thermal conditions for feeding the castings are obtained.

Runners — Metal is distributed around the mold cavity by horizontal runners starting at the sprue base. Although radiographically sound castings have been produced by placing the runners in the cope, placement of runners in the drag is believed to be the better procedure for most magnesium sand casting applications. This arrangement is consistent with the general rule that the metal entering the mold cavity be as low in the mold as possible. Furthermore, dross which has formed during the initial part of the pour may rise to the top side of the runner and adhere to the sand, allowing clean metal to run underneath.

Runners should be extended beyond the last ingate. The extensions act as traps to catch dirt and oxide formed in the early stages of the gating system.

In a two-runner system where nu-

merous gates are employed, connecting the two runner extensions is advisable. This will produce a uniform pressure in the two runners and eliminate a possible variable preferential flow pattern that might be produced if the runners were not connected.

Abrupt changes in the direction of metal flow should be avoided in both the runner and gate system to minimize turbulence. Changes in direction of molten metal flow in the runners and gates are unavoidable. However, the amount of dross formed can be minimized by gradual changes in both direction and area and by the utilization of generous fillets.

Fig. 8 shows systematically and mathematically the relationship of the factors that control the flow of liquid metal in a gating system according to Bernoulli's Theorem. Bernoulli's Theorem has been discussed in detail in an earlier article by Wallace and Evans[1]. It is sufficient to state that the theorem should be understood when designing any good gating system.

Fig. 9 depicts the behavior of molten metal in a horizontal runner by a simplified treatment of Bernoulli's Theorem. In this case, only the velocity and pressure heads are considered. The sketches show that for the same size runner along its entire length the pressure will be low and the velocity high at the first ingate. At the second ingate, the pressure is high and the velocity low. As a result, a large portion of the metal will enter the mold through the second ingate. In the lower sketch, the runner is reduced in size at the first ingate. In this case, the velocity and pressure heads are equal and the same volume of metal will flow into the mold cavity through each ingate.

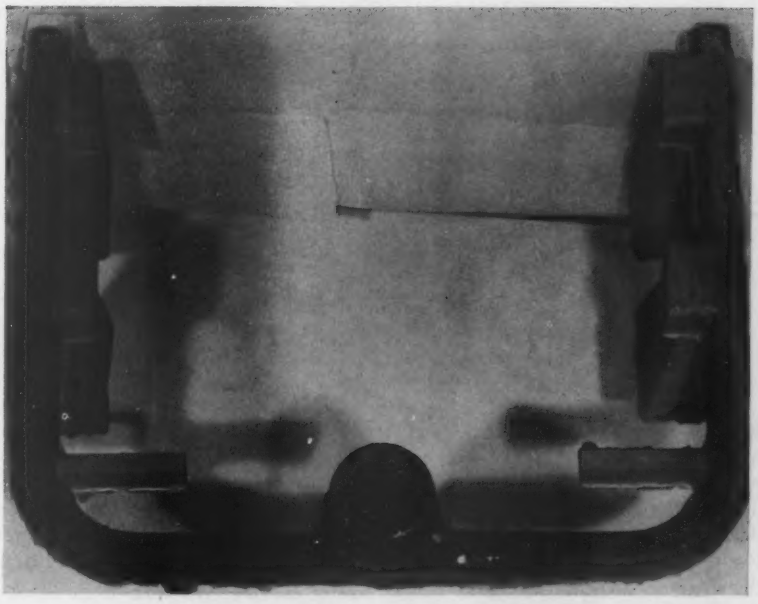
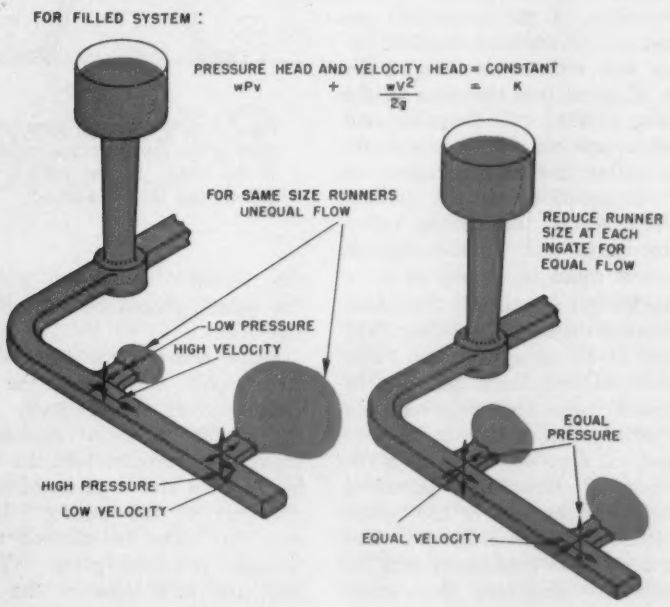


Fig. 10—Differences are shown in oxidation associated with reduction in temperature of the molten metal along the length of the runner

Fig. 9—Velocity and pressure heads are considered in a simplified application of Bernoulli's Theorem to a horizontal runner and two ingates[1]



Castings poured in research laboratories have established that the results predicted from Bernoulli's Theorem are obtained, although a slight adjustment for the resistance to flow through the runner must be made. As a result, almost all recent publications on gating and risering recommend that as each gate is passed the runner size be reduced an amount nearly equal to the area of the gate.

By progressively reducing the runner size, it is assumed that to have the same quantity of metal enter each gate is desirable. One of the basic requirements for making a sound casting is to produce temperature gradients which increase toward the source of feed and thus promote directional solidification. However, equal flow through each gate does not tend to achieve desirable thermal gradients in magnesium sand castings, because of the low specific heat of liquid magnesium.

Let us examine the runner system on the basis of metal temperature rather than metal flow. A temperature drop will occur in the metal as it flows from the sprue

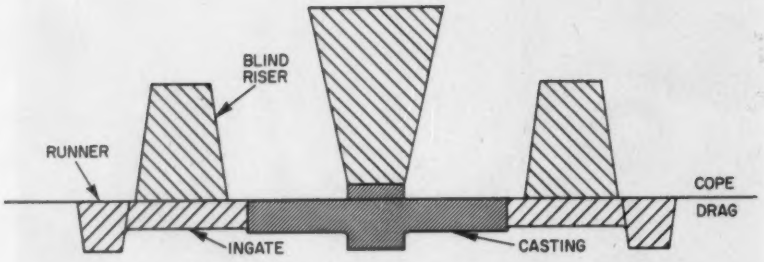


Fig. 11—Blind risers are used to eliminate shrinkage in the area of the ingate. These are used especially when side risers cannot be employed

to the first ingate and the sand forming the runner cavity will be heated. As the metal continues to flow to the second ingate, an additional temperature drop is obtained. For this reason alone, assuming that the distance between the sprue and the first ingate is the same as that between the first and second ingate, the metal entering the second gate will have lost twice as much heat as that entering the first gate. Since all the metal entering both ingates flows over the sand forming the runner between the sprue and the first ingate, the sand in this area becomes hotter than the sand forming the runner between the first and second ingate.

Thus, the sand between the first and second ingate would have greater chilling capacity in most stages of the pour than that between the sprue and the first ingate. A third factor that should not be overlooked is that the sprue and sprue base are always closest to the first ingate. The metal coming down the sprue heats the adjacent sand of the mold cavity, and the sprue base acts as a heat reservoir. Thus, to minimize the temperature variation of the molten metal in the casting cavity, considerably more metal has to enter the end ingate than can be permitted to enter the first ingate.

Temperature adjustments can be made by preferentially reducing the size of the first ingates, chilling the metal entering the first ingates, or by screening at the first ingates to restrict the metal flow. For thin-wall castings, the second method sometimes has to be employed, since misruns would be obtained if the volume of metal entering the casting cavity were reduced substantially by decreasing the size of some of the ingates. The third method has been used successfully when production molding problems make further reduction in the size of the first ingates difficult.

With magnesium alloys, the metal surface will turn from black to silvery-gray through various intermediate shades depending on the temperature of the molten metal in the area. The color change on the surface of the metal in the gating system or in the casting provides a good indication of the initial thermal pattern. Fig. 10 shows differences in oxidation associated with reduction in temperature of the molten metal along the length of the runner.

This runner was connected to a thin wall casting. The severe discoloration at the sprue reflects the relatively high pouring temperature of 1550° F. By the time the liquid metal reached the end ingates, a material reduction in the temperature of the metal had occurred. The width of the first ingates was reduced to restrict the flow of metal into this area of the casting cavity. The second and third ingates are the same size. By this gating practice, variation in the temperature of the molten metal entering the casting cavity is moderate and normal risering practices could be employed.

Authorities generally concede that some degree of turbulent flow occurs in all gating systems. The amount of turbulence that can be tolerated without severely reducing the casting quality has not been resolved. It depends not only on the amount of turbulence generated but also on the area in the system in which the dross is formed. Our experience with production runs indicates that designing the runner size to permit a greater flow of metal to enter the end ingates does not produce any detectable quantity of oxide nor does it adversely affect the quality of the casting.

Ingates—In general, molten metal is conducted by the ingates from the runner to the mold cavity or from the runner to a riser adjacent to the mold cavity. In designing a gating system for a large, complex casting, compromises are the rule rather than the exception. However, whenever possible, the following general rules should govern the placement of gates:

A gate never should be placed between the sprue and the screen. For cope and drag patterns, the first ingate shoud be at least 6 in. away from the screen. For squeezer patterns, the first ingate may be placed as close as 2 in. away from the screen. Whenever possible, the ingates should be directed into side risers.

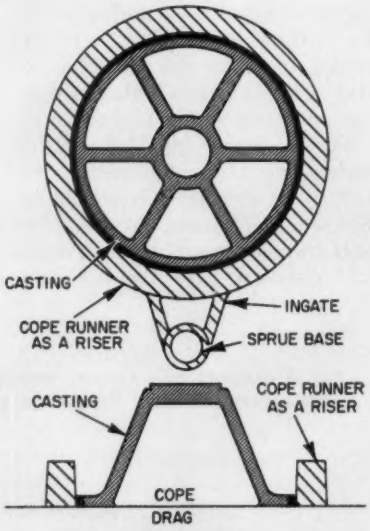


Fig. 12—Cope runners have been used when the casting is molded in the cope. Higher yield is an advantage of this method

Space between the gates should be roughly two times the gate width. This automatically gives the number of gates required, although on complex jobs the number of gates also is governed by the geometry of the casting. In no case can metal be allowed to jet through restricted gates. Therefore, the total area of the gates

must be as large or larger than the area of the runner.

Several ways of designing a gating system may be employed. The horizontal runner may be molded half in the drag and half in the cope with the ingate leaving the runner at the parting line. The runner may be molded in the cope with the ingates at the parting line. Good quality castings have been obtained in each case. Generally, some shrinkage can be expected in the area of the ingates if the metal enters directly into the casting cavity. This is one of the reasons for suggesting that the gate be directed into a side riser, for the riser will feed the ingate area as well as the casting.

If a side riser cannot be provided, a blind riser or a shrink bob over the ingate as shown in Fig. 11 will eliminate shrinkage in the area of the ingate. In many instances, a cope runner has been used effectively as a riser, Fig. 12, and has increased the yield materially. However, in almost every case where a cope runner has proved to be desirable, the casting also has been molded in the cope. When the casting is molded in the drag, either partially or wholly, a drag runner is essential. Fig. 13 shows a method of gating by utilizing a thin, vertical gate to connect a deep drag runner to a casting molded half in the drag.

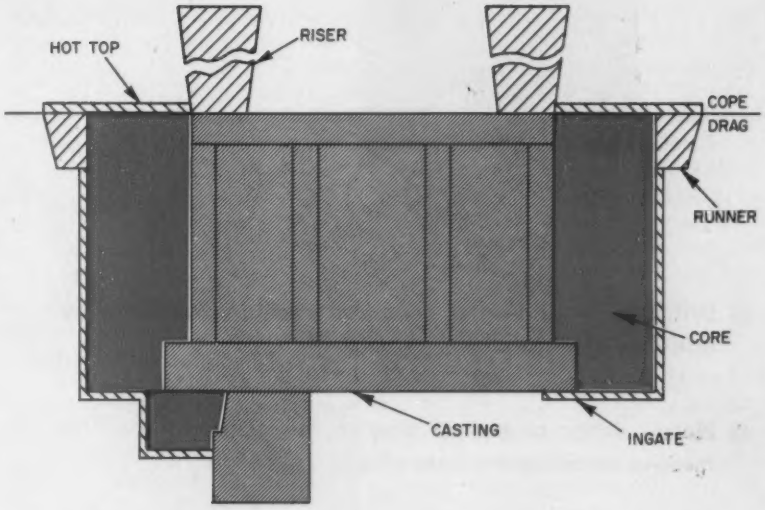


Fig. 14—This casting is molded entirely in the drag and is surrounded by cores. Metal flows through thin ingates into the casting bottom

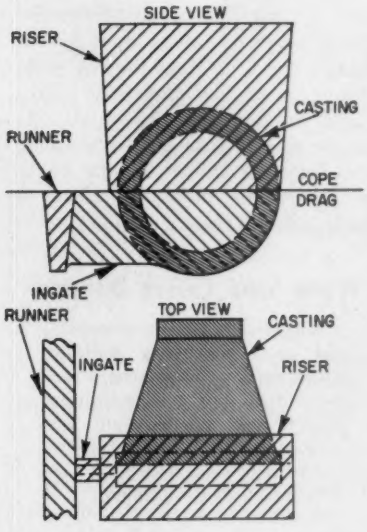


Fig. 13—A thin vertical gate connects a deep drag runner to a casting molded partly in the drag half of the mold

Work of Elliott and Mezoff[3] showed that slot-type sprues did not aspirate gases, and the same principles can be employed in designing ingates. In Fig. 14, the casting is molded entirely in the drag and is surrounded by cores. The metal flows from the drag runner through wide, thin ingates down alongside the core and then under the core to the bottom of the casting. A rejectable part would be obtained by ingating at the top and allowing the metal to drop in the casting.

The ingates are wide to compensate for the reduction in thickness so that the runner and ingates are of substantially the same cross-sectional area. For ease in rigging, the ingates are molded in the drag and are shown as being directly under the runner. This is permissible when only one ingate exists for each runner. When two or more ingates are employed for each runner, the ingates can be molded in the core. Thus, the metal would enter the ingate at the side of the runner and prevent an excessive quantity of metal from dropping down the first ingate.

As is also shown in Fig. 14, the risers are hot-shot or hot-topped from ingates starting at the top of the drag runner. Since oxide films would float to the cope surface, metal that enters the casting cavity should not be taken from the top, but from the side of the runner. In the illustration shown, the hot-topped metal enters the riser and the oxide can float to the surface of the riser rather than the casting. Only on special and rare occasions is the rigging designed so that metal enters the gates either from over or under the runner. Whenever possible, the metal should enter the gates from the sides.

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QUESTIONS and ANSWERS

- **Difficulty in drilling of thin iron castings overcome by addition of graphitizing agents**
- **Needs better control of slag in operating furnace for melting scrap copper-base alloys**
- **Problem with warm molding sand should be corrected at the source**
- **Is considering installing a recirculatory heater unit for increasing blast temperature**

Iron Is Too Hard To Drill

We are having trouble with some thin sections we are making in gray iron. They become so hard that we cannot drill them. Our cupola mixture is built up to take care of our general run of castings, but we have to make some thin ones from time to time. Can you suggest any material we could add to the ladle which would eliminate the problem?

Difficulty with thin sections being too hard to drill can be overcome by the addition of ferrosilicon or other graphitizing agents to the ladle. A number of the latter are sold under various tradenames by firms whose names may be found in the advertising section of FOUNDRY.

The amount of the addition will depend largely on the silicon content of the iron to be softened. For example, if it presently contains 2 per cent silicon, and the section is such that the silicon content should be 2.50 per cent, then 0.50 per cent would have to be added. If 75 per cent ferrosilicon is used, about 0.67 lb or 10.75 oz would be added to 100 lb of iron. Other graphitizing materials would be determined similarly according to the manufacturer's directions for their use.

The ferrosilicon should be in ground form so that it will dissolve easily, and the iron should be hot enough to insure rapid solution.

Encounters Trouble With Slag

We operate a 5000-lb oil-fired rotary furnace which is charged with miscellaneous brass and copper scrap (solids and turnings), using sand and soda ash, or sand and limestone screenings as a flux. For several months we obtain a good fluid slag with normal melting loss, and then we run into a period of thick lumpy slags with high metallic content, excessive melting losses, and a build-up of slag on the furnace wall. This occurs with old as well as new linings, and wonder if you can tell why that condition occurs and a remedy for it.

It strikes us that the first thing to do would be to analyze the slags; from that information you can determine how to make suitable corrections. We believe that your difficulty is the creation of extremely viscous, siliceous slag, and in an effort to thin it out or make it liquid, the temperature is increased so that there is a considerable evolution of zinc oxide. Possibly the incrustation or build-up on the walls might be a combination of lead silicate and zinc oxide due to inclusion of silicon bronze and high-lead bearing bronzes in the charge.

In the case of the sand-soda ash flux, the thinning out could be accomplished by addition of more soda ash, or preferably by cutting down the amount of sand. Soda ash in excess will combine with silica in the furnace lining and corrode it, resulting in low lining life. In the case of sand-limestone the liquefaction can be done by addition of a little more lime or some fluorspar—or, as previously indicated, by reducing the sand. As in the case of soda ash, excess lime and fluorspar will attack the lining to satisfy the needs for silica to form silicate slags.

Warm Sand Causes Difficulty

We operate a nonferrous foundry, and are encountering difficulty when warm molding sand comes in contact with cold matchplate patterns. Do you have any suggestions on how the matchplates can be kept warm during the time it is being used for molding?

It seems to us that you would be much better off to attack your sand problem directly rather than by the approach of heating the pattern plates. In other words make the proper arrangements in handling the hot shakeout sand so that it is cooled to a satisfactory degree. According to some work by Heine, King and Schumacher in *Transactions* of the AFS, 1958, the difficulties of moisture condensation on the pattern and sticking of the sand to the condensate will decrease as the sand is cooled and mulled effectively to below 120° F.

As far as heating the matchplates is concerned, it appears that the most satisfactory method would be to heat with electricity, using en-

closed strip or cartridge heating elements fastened to the plate. While those will serve satisfactorily with plates mounted on a molding machine, we believe it would be a rather awkward arrangement for plates handled on the bench. There it seems that a set up similar to a hotplate would be necessary.

To Install Hot Blast Unit

We are considering the installation of a hot blast system on our cupola, and after study have chosen an independently-fired type heated with gas or fuel oil. One of the plans we considered for its simplicity of maintenance and low cost is a system in which the air is heated directly almost in contact with the flame; the air which is heated in the copper system is the secondary air.

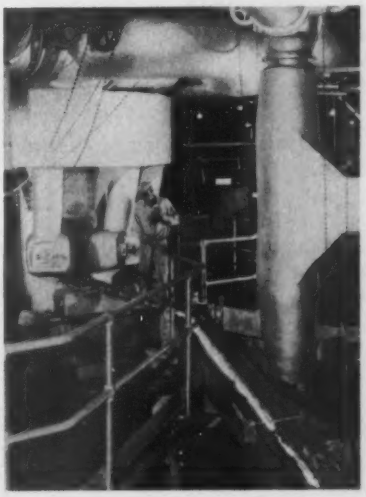
We would like to know what difficulties will occur with respect to combustion gases—CO_2, possibly CO, and those derived from sulfur —which will be introduced through the tuyeres. Will the pickup of sulfur be increased? Have any books been published on hot blast systems, their application to cupolas, etc.?

The heating device you describe for providing the hot blast to your cupola is what usually is termed a recirculatory type—that is, one in which the hot gases generated by the burning fuel are mixed with the air to be heated to raise its temperature to the desired point. So far as we know, that method of heating is not being employed for hot blast equipment for cupolas. The externally fired hot blast units commonly used are heat exchange units, with the air passing through tubes inserted in a chamber which is heated by the fuel.

As to the effect of the CO_2 generated by burning of the fuel and blown into the cupola, it appears that it would be minor. Some available information on heat exchanger type hot blast units indicates consumption of 2800 cu ft of natural gas per hour to heat 3500 cu ft of air per minute to 550° F in one installation. In another about 12.5 gallons of oil per hour is used to heat 2500 cu ft per minute of air to 300° F.

Assuming that the heating device you are considering will use about the same quantity of gas or of oil, rough calculations indicate that the air heated by gas will contain about 1.5 per cent CO_2, and by oil about 1.67 per cent CO_2. Natural gas usually does not contain sulfur, or at the most only a small amount, but sulfur in oil may vary considerably. Even with 4 per cent sulfur in fuel oil, the amount entering the heated air stream would be extremely low, and we doubt that in any case there would be a pickup.

Although there are no books on



hot blast systems for cupolas, a number of articles on the subject have appeared in the literature. Most recent articles in FOUNDRY include "Hot-Blast Cupola Operation," March, 1959, and "Fundamentals of Melting in the Hot Blast Cupola," November, 1960.

Production of Ingot Molds

We operate a foundry in Argentina and would like some information on producing cast iron molds for making steel ingots 24 x 32 x 72 in. Can you tell us the composition of the iron to be used, and the arrangement of the flask, especially the thickness of the sand lining? Is the core arbor drawn out after a period of time to avoid internal strain in the ingot mold casting, and if so what is the length of time? How is the arbor removed?

Since we cannot obtain sufficient broken ingot molds or other scrap with a low phosphorus content, we wonder if we could use a special process iron made in the cupola with hematite pig iron and steel scrap?

Procedure employed by a large steel company for production of its ingot molds was described in the March, 1955, issue of FOUNDRY in an article, "Modern Facilities Incorporated in New Ingot Mold Foundry." It provides information on the equipment and methods used for large-scale production. The operations are mechanized, but instead of using large turntables and sandslingers, the molding and coremaking operations can be carried out on the floor, using pneumatic rammers for compacting the sand.

In this operation the iron used for making the molds is taken directly from a blast furnace. In some other instances the iron is melted in the cupola. Composition of the iron may vary to some extent, but the phosphorus is held low since there is some indication that better life is obtained with low-phosphorus iron, and because the broken molds are charged into the steelmaking furnaces. A suitable composition would show about 1.2 per cent silicon, 0.90 per cent manganese, with total carbon as high as possible, and sulfur and phosphorus as low as possible.

Arbors used for making the cores which form the interior of the ingot mold are made of steel, and are hollow. Patterns for the ingot molds are similar, except that they are not perforated with holes as in the case of the core arbors. Core arbors sometimes are coated with a thin layer of clay wash to aid in making the sand adhere.

The same sand is used for cores and molds, usually a clay-free base silica sand about 50 AFS grain size bonded with about 3 per cent western bentonite, 0.5 per cent pitch, and 5 to 6 per cent water. Both molds and cores are dried prior to use.

As indicated in the article, the flasks or boxes for the cores are made in four pieces with mitered corners, and are held together with clamps. Sometimes they are made in two parts, hinged at one set of corners. The flasks for the molds usually are in two parts with the split on the longest dimension. Sand thicknesses on the core arbor and in the mold lining are about 3 in. Replying to your question about withdrawing the core arbor to prevent trouble, the core and its arbor remain in the mold until the mold

has been shaken out.

The only possible drawback to your proposed melting practice is that the total carbon content may be lower than desired. A carbon content 3.50 per cent or above is believed to give best resistance to thermal shock. Carbon content of your iron could be increased by a graphite addition.

Standardizes on One High Steel Mixture for Wide Range of Sections

Recently we standardized on one cupola mixture for our castings which have sections ranging from ½ to 14 in. Our cupola is lined to 54 in., and using 1500-lb charges, 200-lb coke splits with a 50-in. bed, and 340 lb air with a back pressure of 10 to 12 oz, we are able to melt 9½ tons an hour at a temperature of 2800° F and over.

Iron charges consist of 800 lb steel springs and crankshafts, 300 lb malleable pig, 300 lb returns, and 100 lb silvery pig. To that we add 1 per cent silicon carbide briquets, and with a late silicon addition of 0.15 per cent the analysis shows 3.00 to 3.15 TC, 1.60 to 1.70 Si, 0.60 to 0.70 Mn, 0.08 P, and 0.06 to 0.09 S. Tensile strengths are 40,000 psi or more.

Previous to the addition of silicon carbide we had sparking at the cupola spout, and we would like to know if the reduction in sparking is caused by the calcium in the carbide, which contains 7.68 Ca, 0.40 Si, and 0.20 C.

Using the same base mixture we left out the silicon carbide and made a late addition of 3 lb calcium silicon and 2.5 lb ferrosilicon (75 per cent) per 1500-lb charge. Tensile strengths increased 5000 to 10,000 psi except in our alloy iron. We obtained 42,000 psi on a 1.2-in. bar. Analysis showed 2.80 TC, 1.68 Si, 0.58 Mn, 0.053 P, 0.096 S, 0.85 Ni, 0.37 Cr, and 0.29 Mo. Why the low strength when other iron from the same heat showed tensiles of 50,000 psi and over? Again was the increase due to calcium?

We try to control the chill depth by a late addition of ferrosilicon or calcium silicon. Would you suggest any change in the 53 per cent steel mix? Most castings are poured in the 3.55 to 3.80 carbon equivalent range. What will this iron do to section sensitivity? How can we check that characteristic? Perhaps by making a slight change in the 53 per cent mix, we could nearly always obtain type A, random flake graphite.

Your melting conditions are quite satisfactory, but there is some doubt about the figure of 340 lb of air used. According to the information you give, you are burning about 42.2 lb of coke per minute, and each pound of 90 per cent carbon coke requires about 10.3 lb of air. Hence, the air supply should be around 433 lb per minute.

Your back pressure seems somewhat low, but that probably is due to the open condition of the large quantity of steel springs and crankshafts included in the charge.

Possibly the open charge is the reason for the sparking of the iron at the spout. According to available information, silicon carbide acts as a deoxidizing agent, and that function results from the presence of nascent carbon and silicon generated when the silicon carbide dissolves in the molten iron. We do not have any information on the chemical composition of the carbide, but it is our understanding that it essentially is silicon carbide which theoretically contains 70 per cent Si and 30 per cent C.

With reference to the differences in strengths between the two practices employed, we believe it is due to the higher degree of inoculation in the second case where the late addition of silicon is almost twice that in the first where silicon carbide also is used in the cupola. Possibly an even more pronounced effect could be obtained by reducing the silicon content of the metal charged into the cupola and increasing the late silicon addition by the same amount. For example, you might try a late silicon addition of 0.50 per cent.

We cannot give any definite decision on the reason for the alloy iron not showing a marked increase in tensile strength with the increased late silicon addition. As you undoubtedly know, the effect of inoculating agent decreases with the length of time the metal is held in the molten state before pouring. Possibly that might be the cause of the apparent ineffectiveness.

We are not in a position to suggest any changes in your mixture. You are on the ground, and can see the results which apparently are satisfactory. The only thing which might be tried is to increase the late silicon additions after making a corresponding decrease in the silicon in the raw metal charge. That also should promote formation of the desired type A graphite.

You can get some idea of the section sensitivity of the iron mixtures by pouring test bars which have approximately the same volume/area as the section into which the iron will be poured. In other words, the cooling rate of the test bar should be comparable to that of the section of the casting.

Long Castings Tend To Warp

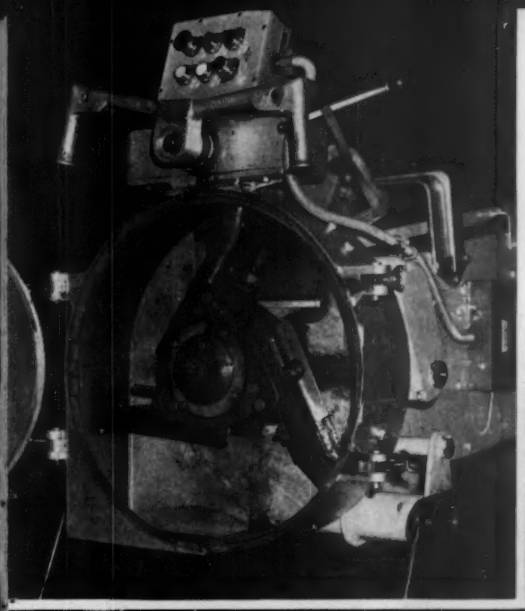
We make abrasive-faced aluminum sills for elevators which are poured red hot to hold the abrasive. Some of the sills are 9 and 10 ft long. They are 7½ in. wide and gated from one end. Some have two ribs and some three, and all are chilled down the middle. Difficulty is that they bow or warp.

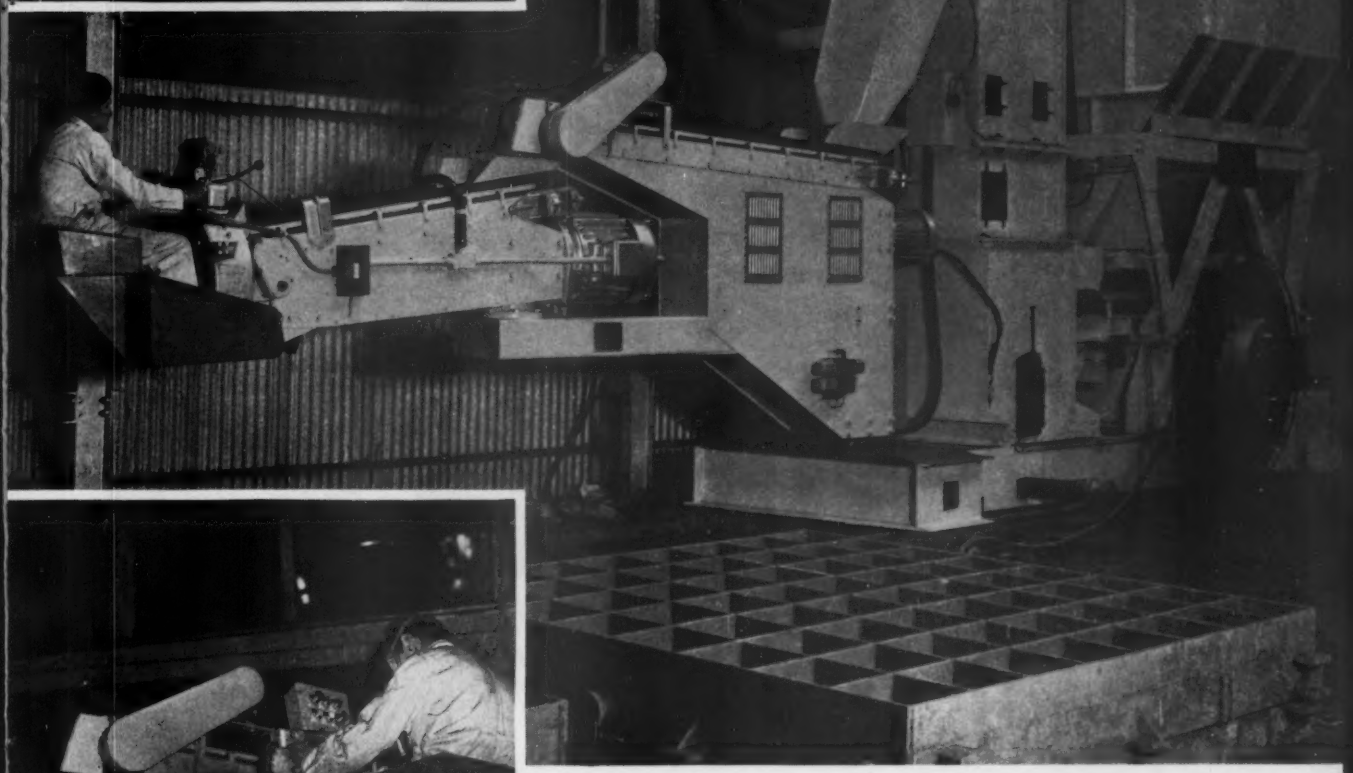
Warpage or bowing is caused by the differences in solidification rates between the various parts of the casting, thereby setting up stresses. You might be able to overcome the trouble by modification of the gating. The present system introduces all the metal into the long casting at one end, requiring the metal to run a long distance. The metal reaching the far end obviously has lost considerable heat by the time the mold cavity is filled, and solidification must start at that end rather rapidly. At the end where the metal is introduced the sand is overheated, and the combination of the two sets up unequal cooling.

It appears that the solution is to place a runner along the side of the casting with multiple ingates which would fill the mold rapidly without developing local hot spots. Also, the metal would have to run only across the 7½ in. width of the casting instead of 9 or 10 ft.

Possibly a single sprue in the center of the long runner, which would mean running the metal 4 ft or so, might serve since you are pouring the metal at a high temperature. Ordinarily with the usual pouring temperatures for aluminum, the distance would be too great, and several sprues would have to be used.

Up to a ton of sand per minute *with* F.E.'s mobile SANDRAMMERS!





These high speed Mobile Sandrammers feature F.E.'s exclusive "Turbo-Ram" head for uniform-velocity, hard-ram delivery of sand. No. 4 Rammer is self-powered, with full automatic control from head, 15′ operating radius. Feed unit includes 7½ ton drop bottom tank and spare tank. Output up to 2000 lbs. per minute. No. 3 Rammer has a 10′ operating radius, with head operated by hydraulic power or remote control. Longer jibs available for extra large work.

Additional information and prices on request.

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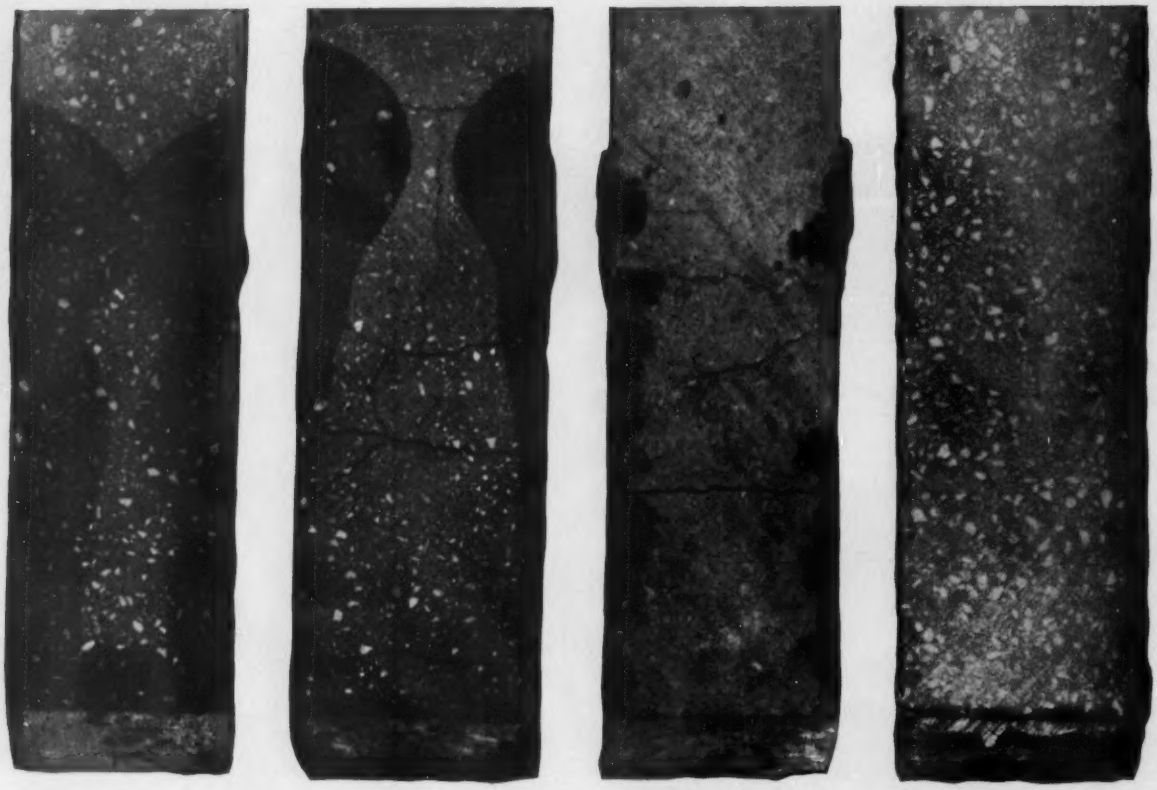
Circle 593 on Page 39

NEW KAISER LO-SIL* REFRACTORIES VIRTUALLY STOP ALUMINUM PENETRATION

These are unretouched photographs of cross sections of brick after a molten aluminum immersion test at Kaiser Aluminum's Department of Metallurgical Research, Trentwood, Washington. Dark areas show aluminum penetration.



BRAND A
90% ALUMINA BRICK
7 DAYS
in 7075 alloy at 1400° F.

BRAND B
90% ALUMINA BRICK
15 DAYS
in 7075 alloy at 1400° F.

BRAND C SPECIAL
HIGH ALUMINA BRICK
30 DAYS
in 7075 alloy at 1400° F.

NEW LO-SIL SUPER
30 DAYS
in 7075 alloy at 1400° F.

Kaiser Refractories' new Lo-Sil Regular and Lo-Sil Super refractory brick—designed especially for aluminum melting furnaces—achieve a major victory in saving metal, increasing purity, and extending refractory life.

Repeated tests prove Lo-Sil Super resists aluminum attack 30 times better then other low-silica, high alumina brick . . . and virtually eliminates loss of metal by absorption!

Controlled comparisons show Lo-Sil Super reduces silicon pickup to about one-twentieth that of standard 90% alumina brick. Refractory inclusions are nil. Dross removal is easy. Through increased resistance to thermal shock, impact and abrasion, Lo-Sil Super brick extends lining life and greatly reduces down-time.

Ask your Kaiser Refractories Sales Engineer about new Kaiser Lo-Sil Regular and Lo-Sil Super Brick—plus Lo-Sil Mortar.

Mail coupon at right for free copy of "Kaiser Lo-Sil Refractories," or contact Kaiser Refractories & Chemicals Division, Kaiser Aluminum & Chemical Sales, Inc. (Canadian Subsidiary: Refractories Engineering & Supplies, Ltd.)

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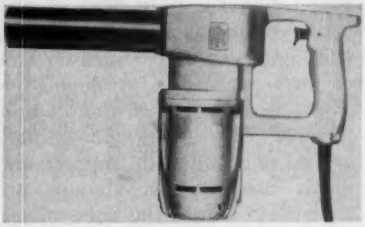
New EQUIPMENT and SUPPLIES

For More Information, Use Reader Service Card—Page 39

CHIPPING HAMMER

Electric chipping hammer weighs 12¾ lb with the cable. A spring is used to increase piston impact and is claimed to eliminate maintenance problems caused by leaky air cushions and broken rubber thongs. Designated Model H541U,

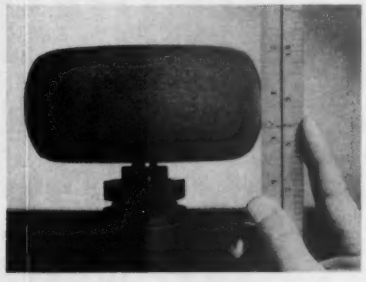


hammer is 15¾ in. long and 8 13/16 in. high with a ⅞-in. side to center distance at the barrel. Unit operates on standard 115-v ac or dc with a motor rating of 5 amp. Motor for 230-v operation and 2.5-amp rating can be furnished. — **Ingersoll-Rand Co.**, 11 Broadway, New York 4, N. Y.

For More Details Circle No. 451—Page 39

ABRASIVE BANDS

Coated abrasive bands assume various degrees of crown when run on inflatable rubber drums. Bands



are made of aluminum oxide abrasive in grits 40 through 180 bonded on X-weight cloth with resin adhesives. They assume a crowned shape when the pneumatic wheel is inflated. Once the crown has set, pressure in the wheel can be reduced. Degree of crown depends on grit size, air pressure in the wheel, wheel speed, and pressure exerted on the work. Bands are available in three sizes—2 x 9⅝ in. for maximum speed of 6000 rpm, 2½ x 15½ in. for 4500 rpm, and 2 x 19 in. for 4000 rpm.—**Behr-Manning Co.**, division of Norton Co., Troy, N. Y.

For More Details Circle No. 452—Page 39

RADIOGRAPHY CAMERAS

Radiography cameras with capacities of 10, 25, 35, 50, and 100 curies of iridium 192 are available for industrial radiography. All units are portable and vary in weight from 50 to 100 lb. They are designed for panoramic and internal radiography, where the machine is used to position the source. Iridium 192 is useful in radiographing steel ¼

to 3 in. thick or aluminum ¾ to 9 in. thick.—**Radionics Inc.**, Lafayette & Water Streets, Norristown, Pa.

For More Details Circle No. 453—Page 39

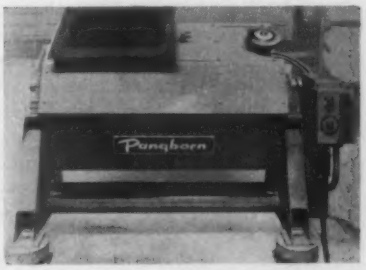
FLUX APPLICATOR

Flux applicator, called Reverbagun, is a portable pressure device intended to apply cleaning flux to walls of large aluminum-melting furnaces to remove oxide buildup. It also can be used to apply covering and drossing-off fluxes. Unit consists of a cylindrical flux tank, pressurized by connection to any low-pressure air line; a discharge hose; and a lance fitted with a spreader.—**Foundry Services Inc.**, P. O. Box 8728, Cleveland 35, Ohio.

For More Details Circle No. 454—Page 39

VIBRATORY FINISHING UNIT

Vibratory finishing machine holds up to 500 lb with a work container capacity of 1½ cu ft. Unit has same features as other machines in company's line. In addition, Model 1½ YA has mechanical motion control to vary frequency and amplitude over the available range while the machine is operating. Unit



is supported by nonvibrating system of air cushions when structural limitations prevent use of spring-mounted machine.—**Vibratory Finishing Div., Pangborn Corp.**, Hagerstown, Md.

For More Details Circle No. 455—Page 39

CORE TRUCK

Core truck Model D-1 has a loading capacity of 500 lb. Upper loading tray is 27 x 72 in. and is mounted on coil springs. Auxiliary tray is 27 x 46 in. Running gear consists of 16-in., four-ply tubeless pneumatic tires and 5-in. guide wheels.

—**Arco Welding Service**, 4727 S. Hoyne Ave., Chicago 9, Ill.

For More Details Circle No. 456—Page 39

ADJUSTABLE CHECKING GAGE

Adjustable gage is offered for checking critical dimensions of castings. Unit has two pairs of arms, one on each side, so that maximum and minimum tolerances

can be set on it. Each pair of arms is marked, one pair with green and the other with red, to indicate which pair is set with acceptable and unacceptable dimensions. Gage can be set up to check inside dimensions up to 5 in. and outside dimensions up to 3 in.—**Speed Tool Co.**, 1144 N. La Brea Ave., Los Angeles 38, Calif.

For More Details Circle No. 457—Page 39

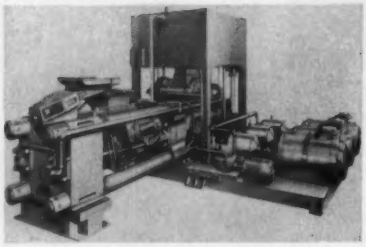
DISC SANDER

Disc sander is designed for use with 7-in. disc. Features include spiral bevel gear power transmission, diecast aluminum housing, reversible side handle, and ball-shaped rear handle grip. A molded plastic tool rest on the back of the sand prevents scratching or marring of work. Unit weighs 8¼ lb. A similar model for polishing also is available.—**Black & Decker Mfg. Co.**, Towson 4, Md.

For More Details Circle No. 458—Page 39

SCRAP BRIQUETING PRESS

Automatic briqueting press is said to be capable of converting up to 9 tons of machine tool scrap per hour into cylindrical briquets weighing



from 30 to 40 lb each. Designated Model AL-1000, the unit is powered by three 125-hp electric motors. Cylinder pressure plates and die holders are cast steel, and piston rods are chrome nickel steel, hardened and ground. Unit is suitable for briqueting cast iron, steel, uranium, zirconium, bronze, brass, aluminum, magnesium, titanium, and molybdenum. — **Milwaukee Foundry Equipment Div., SPO Inc.**, 6448 W. Bruce St., Milwaukee 46, Wis.

For More Details Circle No. 459—Page 39

WELDING HELMET

Welding helmet is made of fiber glass and features a molded neoprene lens retainer mounted on it without any fasteners. Electrical conductivity between the exterior and interior is eliminated by use of nonconductive materials for the pivot assemblies and chin rest bolts. Lens is 4½ by 5¼ in., and glass or plastic filters may be used. With plastic filter, the helmet is said to be 7 oz lighter than similar helmets with glass lenses and metal retainers. Rubber lens retainers serve to protect the lenses if the helmet is dropped, and no special tools are required to change the lens. Nylon headgear features a cross strap adjustable for height and position plus a replaceable foam sweatband on headband and cross strap.—**Chicago Eye Shield Co.**, 2727 W. Roscoe St., Chicago 18, Ill.

For More Details Circle No. 460—Page 39

BIN VIBRATOR

Bin vibrator is designed for installation on chutes, hoppers, and bins with wall thicknesses of ½ in. and up to 50-ton capacity. Two or more units can be mounted on bins of larger capacity. A double-impact system is used in the vibrator to give 7200 blows per minute against the bin wall. Impact elements used in the vibrator are claimed to reduce the noise of op-

eration. Mounting the vibrator is accomplished by bolting it to a bin wall and plugging it into a 60-cycle electrical outlet. A special unit is available for use in hazardously dusty conditions. Photo shows Model 7OU and a smaller one.—**Eriez Mfg. Co.**, Erie 6, Pa.

For More Details Circle No. 461—Page 39

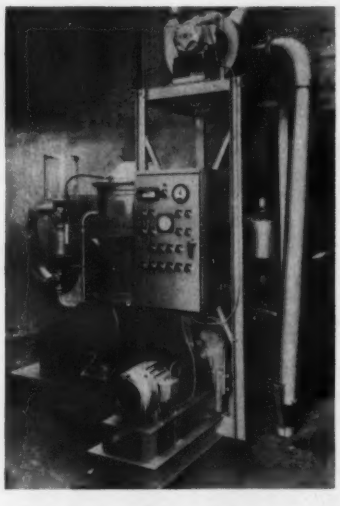
OVERHEAD TRACK SWITCHES

Overhead track switches are designed for loads of 2000 to 4000 lb. They are of steel construction, assembled in jigs to assure accuracy and permanency of alignment. Units are made for lefthand, righthand, and three-way operation; for manually-operated and motor-propelled

Packaged Unit Prepares Coated Shell Sand

Shell sand coating plant Model 150 is made up as a compact packaged unit with all equipment mounted on a steel bed. Unit is wired and piped completely; at installation, only air lines and electricity must be connected to it. The timer control panel provides for automatic operation, and capacity production is said to be as much as 4 to 5 tons per day.

Incoming air is heated electrically. A measuring and injection unit controls the amount of liquid resin used and is said to eliminate loss from spillage. Sand is loaded into the machine by an air-operated bucket loader, and a toggle action discharge door unloads hot coated sand directly onto the vibrating screen of the cooling system. This auxiliary equipment is operated from



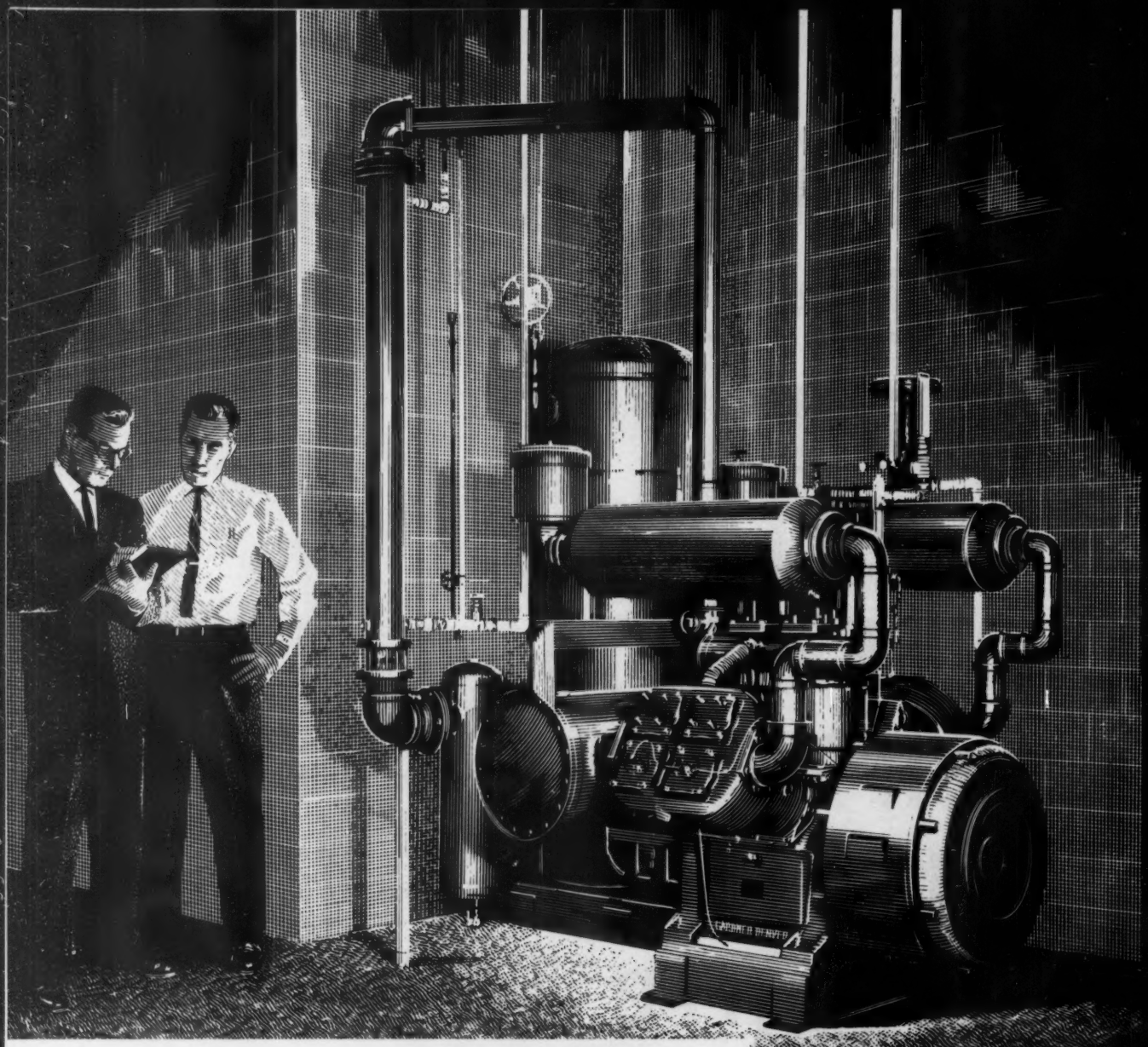
the control panel.—**Shalco Div., National Acme Co.**, 170 E. 131st St., Cleveland 8, Ohio.

For More Details Circle No. 480—Page 39

GENERAL FOODS ANNOUNCES NEW UNICORE BINDER FLOUR... PROCESSED TO YOUR OWN DENSITY NEEDS ... GUARANTEED UNIFORMITY... CAN SAVE YOU 20% IN BINDER COSTS!

G.F.'s new UNICORE process is an advanced technical development in the production of foundry binder flour. Rigid control now permits you to choose the binder density—ranging from 425 to 600 grams—that suits your operation best. Some foundries have actually discovered they can reduce the usage level of UNICORE and save up to 20% in binder costs ■ ■ ■ while maintaining their high-quality standards. The difference is the new UNICORE process which develops unusual physical properties in addition to those measurable by standard lab tests. You can prove UNICORE's quality in your core room. Send for a free sample today: General Foods Corn Mill, 1551 East Willow Street, Kankakee, Illinois.

Circle 595 on Page 39



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The difference? Saving in floor space. No foundation cost. Quick and easy installation. The Gardner-Denver packaged air compressor goes right to work . . . provides a dependable supply of air for years. Want details? Request Bulletin WB-10.

Gardner-Denver Company, Quincy, Illinois
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Circle 596 on Page 39

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

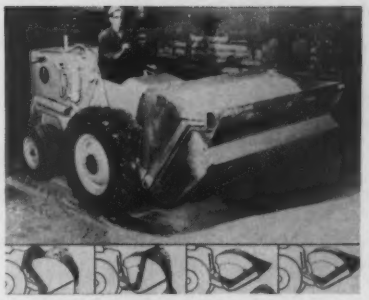
GARDNER-DENVER

systems. The inner track-carrying frame rides on antifriction rollers. Switches can be shifted by hand, electric, or air power and a latch mechanism holds the switch in position. Guards are provided to prevent carriers from running off open ends of incoming rails.—**Cleveland Tramrail Div., Cleveland Crane & Engineering Co.**, Wickliffe, Ohio.

For More Details Circle No. 462—Page 39

BUCKET SPILL GUARD

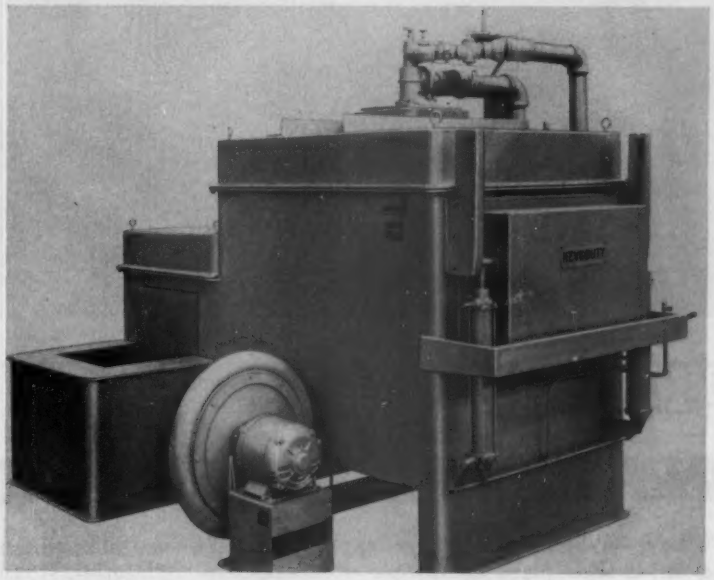
Device to reduce spillage of bulk materials being transported in tractor buckets is available with company's line of tractor shovels. Side sheets of buckets are curved to conform with an arc traveled by a combination striker bar-spill guard. Device is operated hydraulically to move from top side of the bucket to the front and strike off excess material.



It remains at the front as the bucket is rolled back and lifted to carry position. During travel, the device serves as a spill guard. When the material is to be dumped, it is moved to the back of the bucket. Spill guard is operated hydraulically and separately from the bucket.—**Frank G. Hough Co.**, 798 Seventh Ave., Libertyville, Ill.

For More Details Circle No. 463—Page 39

Furnaces Melt and Hold Aluminum Alloys



Line of aluminum melting and holding furnaces is available for use in aluminum sand casting, diecasting, and permanent mold plants. All models are of single unit construction with individual melting and holding chambers plus a choice of dipout locations. Separate firing systems in each chamber assure rapid melting in one chamber and correct holding temperature in the other. Gas, oil, or combination fuels can be selected as the fuel for heating these units.

Steel plate shells are reinforced with structural shapes to prevent warpage, and fire brick or silicon carbide linings are used, according to customer needs. Depending on size and type, these furnaces are capable of melting and holding from 250 to 2000 lb of aluminum. — **Hevi-Duty Electric Co.**, division of Basic Products Corp., Milwaukee 1, Wis.

For More Details Circle No. 481—Page 39

New EQUIPMENT and SUPPLIES

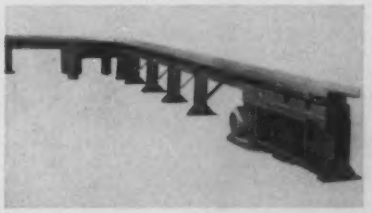
SAFETY GLASSES

Safety glasses are offered in six color models including two-tones. They come with or without side shields. Features claimed for these glasses include wider temples, seven-barrel hinge, screws constructed so that they will not fall out, and sturdier frames.—**American Optical Co.**, Southbridge, Mass.

For More Details Circle No. 464—Page 39

CONVEYOR SYSTEM

Materials handling system is adaptable to nearly any application for which solid materials can be conveyed on a horizontal plane.



Multiple carriers in the system are said to enable storing of small parts and feeding them into operations at speeds to meet production requirements. Advantages claimed for the system are reduction of handling and rehandling of parts; elimination of racks, pans, and storage bins; and provision of a continual flow of work to the point of use. Conversion units are available for use in annealing or hardening furnaces.—**Mathews Conveyer Co.**, Ellwood City, Pa.

For More Details Circle No. 465—Page 39

DRESSING TOOLS

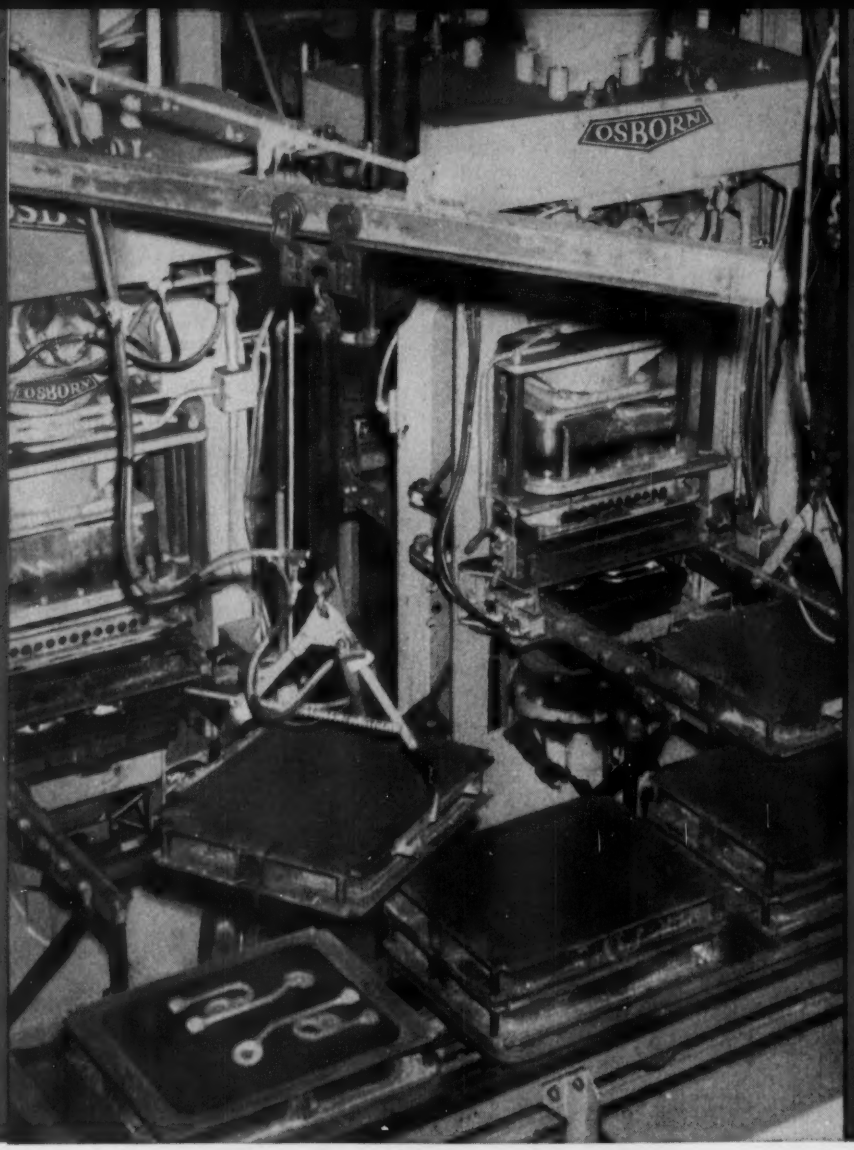
Diamond dressing tools are non-resettable and can be turned in for salvage value. Single point diamonds are used in these expendable units which come in a variety of shapes and sizes for all straight and form dressing needs.—**Diamond Tool Research Co.**, 380 Second Ave., New York 10, N. Y.

For More Details Circle No. 466—Page 39

HIGH-SPEED CYLINDERS

Floating cushions, available as options on company's line of hydraulic cylinders, are said to permit faster cycling than has been possible with other cushioned cylinders. In high-speed cycling, the floating cushion plunger acts as a

OSBORN MODEL 19-M. This Series "M" Molding Machine is designed for high-volume production of smaller molds. Series "M" Machines produce superior quality molds which give castings high dimensional accuracy and excellent surface finishes. Tappan uses two Model 19-M machines to blow-squeeze cope molds in the setup shown in the photo at right. Completed copes are swung out on bails and manually closed over drags. Two other Model 19-M machines are used to blow-squeeze drag molds.



OSBORN **FIELD REPORT:** *AUTOMATIC MOLD PRODUCTION AT TAPPAN*

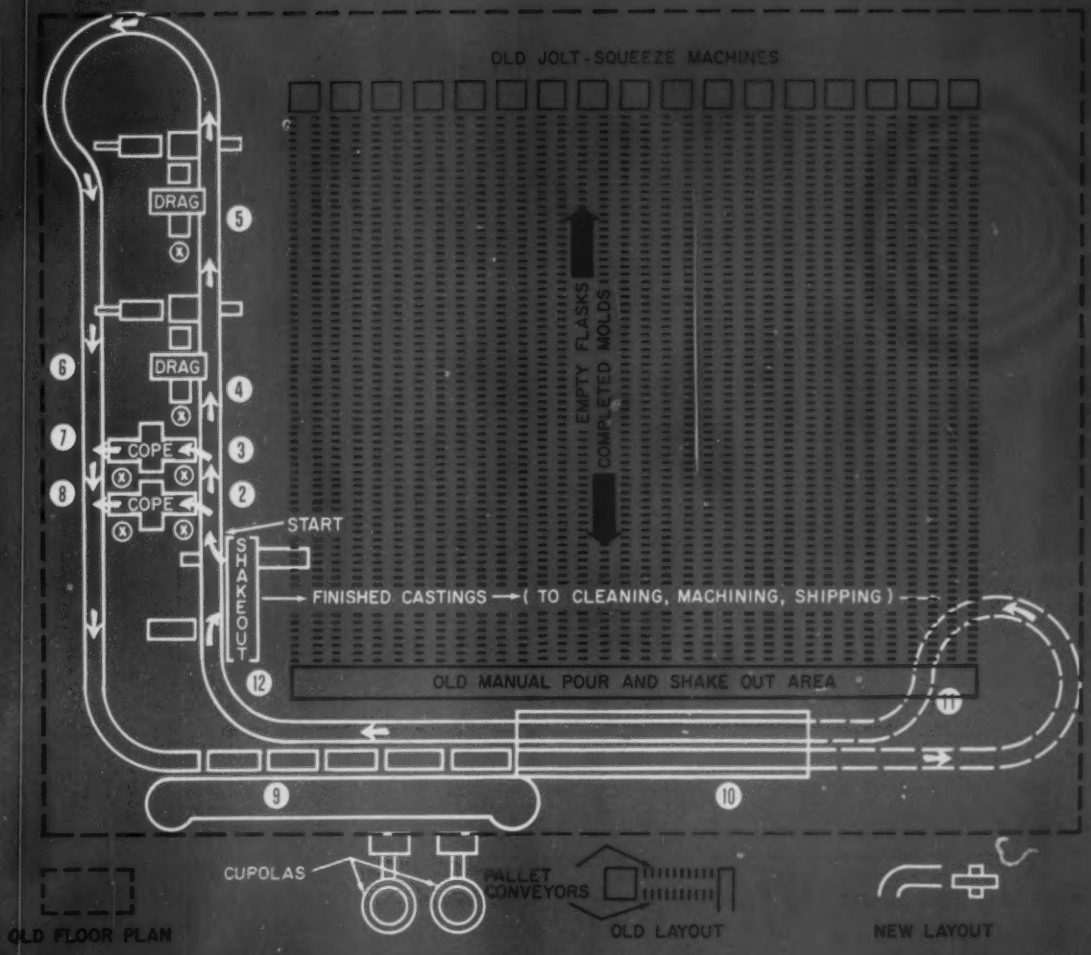
TAPPAN FOUNDRY PRODUCTION

Here's how—When The Tappan Company decided to centralize all foundry operations at their plant in Murray, Kentucky, an engineering study was conducted with the aid of the Osborn foundry engineering staff.

These were the problems

- Production of stove grates and burners had to be doubled to fill the requirements of the Murray plant as well as other Tappan facilities.
- In spite of planned expansion (from 160,000 to 230,000 sq. ft.), a sharp reduction had to be made in the 23,000 sq. ft. allocated to the foundry in order to accommodate growth in other production operations.
- Production costs had to be low enough to offset shipping costs.
- A minimum capital investment was essential in Tappan's plans.

The solution—A completely new layout for semi-automatic foundry operations was developed. Four Osborn Series "M" Molding Machines were installed, replacing seventeen jolt-squeeze machines. Two of these Series "M" Machines are used for cope production, two for drag production. The L-shaped layout (shown above) is enclosed by a 400-foot loop conveyor. Other related operations—cleaning, machining, shipping—are all efficiently located immediately adjacent to the molding line.



HERE'S HOW IT WORKS—The *new* Tappan layout (in white) completely replaces former installation (in black). Empty flasks enter conveyor at "start". At 2 and 3, empty copes are moved into two Series "M" Machines for cope molding. Completed copes are removed at 7 and 8, and closed with finished drags. Empty drags enter two Osborn Series "M" Machines at 4 and 5. Completed drags are automatically transferred, and cores are set at 6. Pouring is done at 9. Conveyor line drops underground at 10 for cooling through 11. Shakeout is performed at 12, completing the closed-loop cycle.

DOUBLES IN HALF THE FLOOR SPACE

The results — Each Osborn Series "M" Machine produces a finished mold within 15 seconds. Extremely rapid Series "M" cycle time amply fills current production requirements . . . with *reserve* capacity for near-future needs. Flexibility of the Series "M" equipment allows patterns to be changed in 5 to 6 minutes. Floor space requirements for the foundry operation were cut to 15,000 sq. ft. Low unit costs now make shipments to Tappan's other plants economically possible. And only minor adaptations will be required to make the installation *fully automatic* for handling even greater future production volume.

Osborn Molding Machines and Core Blowers are *all* engineered to cut costs . . . increase productivity . . . conserve space in production, semi-production and jobbing foundries. Write for full details and technical bulletins for *your* specific applications.

THE OSBORN MANUFACTURING COMPANY

5401 Hamilton Avenue • Cleveland 14, Ohio • ENdicott 1-1900

leader in mechanization for the foundry

MOLDING MACHINES • CORE BLOWERS
METAL FINISHING MACHINES . . . and FINISHING METHODS • INDUSTRIAL BRUSHES

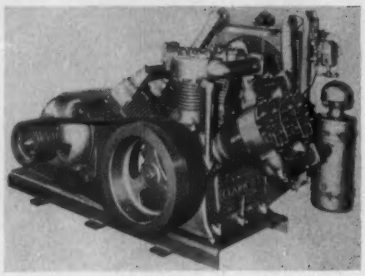
Circle 597 on Page 39

large check valve that allows comparatively large volumes of fluid to enter the cylinder around the piston rod. This feature speeds up the start of the cylinder stroke in coming out of the cushion. An additional feature is a floating sleeve that adjusts itself to maintain effective cushioning at fast or slow speeds. Cushions are available on cylinders with bores from 1½ to 14 in.—**Miller Fluid Power Div., Flick-Reedy Corp.**, Bensenville, Ill.

For More Details Circle No. 467—Page 39

AIR COMPRESSORS

Line of air compressors is available in 25, 50, 75, and 100-hp sizes. Two-stage compression, intercooling between stages, generous valve areas, and large air passages are features of these units. W-type construction shortens over-all crankshaft and compressor length, minimizing floor space requirements. Good running balance is claimed to simplify foundation requirements. Crankcases and



cylinders are cast iron, the crankshaft is a steel forging which runs in two large tapered roller bearings, and forged steel connecting rods have babbitt bearing inserts.

Constant speed load and unload device is standard equipment. Optional control for intermittent operation permits start-stop duty for both motor and compressor or continuous motor operation and free air compressor unloading.—**Clark Bros. Co.**, Olean, N. Y.

For More Details Circle No. 468—Page 39

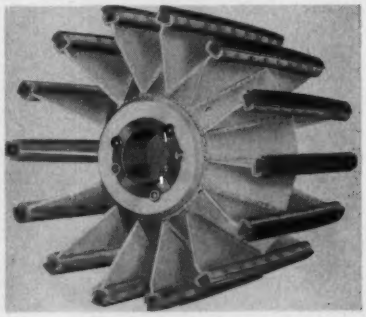
LIMIT SWITCH

Lever limit switch designated No. IC9445 with more than 100 contact and lever combinations is designed for versatility. Unit is available for either two or four-circuit operation with general-purpose, weatherproof, water-tight, or dust-tight enclosure. Phenolic cams can be rotated for any contact arrangement. Selection of lever arms includes straight levers with 1 or 2¼-in. nylon rollers, a slack-cable lever, a forked lever, and a lever for crane-hook service.—**General Electric Co.**, Industry Control Dept., Salem, Va.

For More Details Circle No. 469—Page 39

WING PULLEY

Wing pulley is constructed with a U-shaped steel channel at the edge of each wing to hold a rubber bar. Rubber lagging is claimed to grip



the conveyor belt. When the lagging contacts the belt, the rubber is compressed. When contact is broken, rubber springs back to its original height. This action is said to provide automatic cleaning of the pulley plus spalling-off of dried material on the underside of the conveyor belt. Lagging has been designed so that it is simple to replace. —**Van Gorp Mfg. Inc.**, Pella, Iowa.

For More Details Circle No. 470—Page 39

PROTECTIVE GOGGLE

Protective goggle is molded of rubber and features wide angle vision. Unit is claimed to fit over any modern eyeglass frame. Aluminum vents are used in the model for welders and chippers.—**Safety Products Dept., Bausch & Lomb Inc.**, Rochester 2, N. Y.

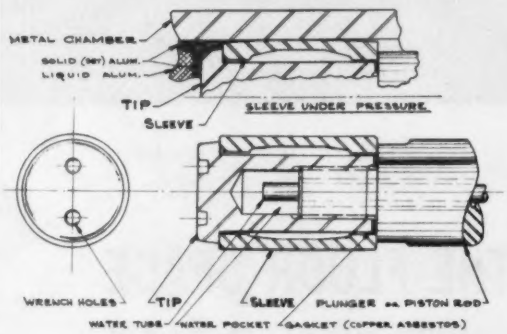
For More Details Circle No. 471—Page 39

CRANE CONTROL CABLE

Cable, trolley, and track arrangement controls floor-operated cranes and advances and retreats across the width of the span with the operator. Cable can be moved 15 degrees from the perpendicular so that the oper-

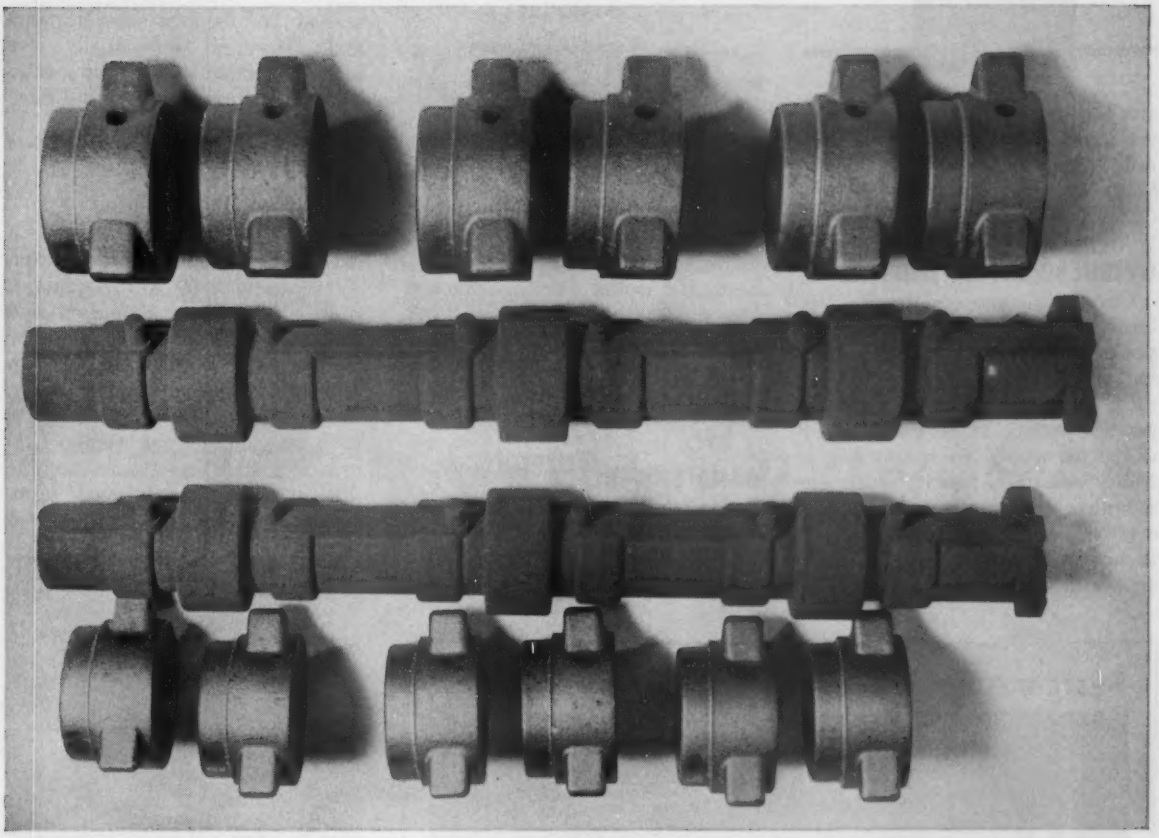
Sleeve-Type Shot Tip Eliminates Misalignment

Problems with misalignment of the plunger tip in the injection system of a die-casting machine are said to be reduced or eliminated by a new system. When misalignment occurs, the tip and magazine wear out quickly. To prevent this difficulty, a sleeve-type shot tip, as shown in the illustration, is used. The sleeve has a self-aligning clearance which corrects rod-to-shot magazine misalignment. It operates at a constant temperature while the cooled tip sets the hot metal. If replacement becomes necessary, only the sleeve is changed.



Other features include mounting the injector cylinder directly to a shot magazine holder which is carried by the stationary platen of the machine without any additional cylinder support. In addition, the plunger tip is cooled by the hydraulic fluid used in the injection cylinder. Coolant passes through an orifice, or check valve, into the tip, back through the cylinder rod, and out through two small holes through the heat exchanger to the hydraulic fluid reservoir. This system and the components of it are adaptable to existing equipment.—**Werco Engineering Co.**, 946 13th Ave., Grafton, Wis.

For More Details Circle No. 482—Page 39



Look what happens to costs when foundry switches to shell cores made with Durez resins

Lavelle Foundries, Anderson, Indiana, casts such things as pump parts, motor housings, venturi fittings and other parts for gas burners. Small, light, a lot of them are needed to account for a ton of iron.

So scrap losses came high. Or did, until shell cores' quality and accuracy helped cut them down to a minimum. More important, with shell cores made from Durez foundry resins it is possible to find and correct the *causes* of poor castings within a few hours, instead of the days or even weeks often required with sand cores.

And costs tumbled even further when gang cores were employed. It took only two cores to make the 12 castings shown in the photo . . . where, before, eight single cores were set per mold.

Finally, with better finishes, closer tolerances, more uniform wall thickness, Lavelle castings save additional sums for customers. Less machining, fewer secondary operations.

OTHER ADVANTAGES

No need for core dryers, less chance for warpage, uniform heat transfer over entire core surface. Less sand to buy, less to handle. Cores are lighter, tougher, can be stacked in stockpiles.

Write for a copy of *Durez Guide to Shell Molding.* It contains all the very latest data on this cost-cutting method.

DUREZ PLASTICS DIVISION

HOOKER CHEMICAL CORPORATION, 1001 WALCK RD., NORTH TONAWANDA, N. Y.

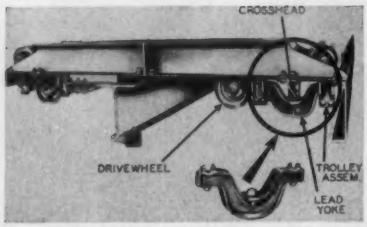
HOOKER CHEMICALS PLASTICS

ator can lower a load with accuracy, yet stand safely clear of it.—**Shepard Niles Crane & Hoist Corp.**, Montour Falls, New York.

For More Details Circle No. 472—Page 39

OVERHEAD CRANE END TRUCK

Overhead crane end truck gives flexibility when used on rigidly supported runways. Unit is available for all the company's under-running, motor-driven cranes with capacities from 1 to 10 tons. A pair of flanged wheels are mounted on a trolley assembly, two of which are mounted, in turn, at either end of a yoke. The frame of the end truck is suspended from this yoke by a crosshead supported on a 2-in. diam



hardened steel ball. Yoke, crosshead, and trolley assembly brackets are malleable iron, and wheels are forged steel.—**Spanmaster Div., Jervis B. Webb Co.**, 8951 Alpine Ave., Detroit 4, Mich.

For More Details Circle No. 473—Page 39

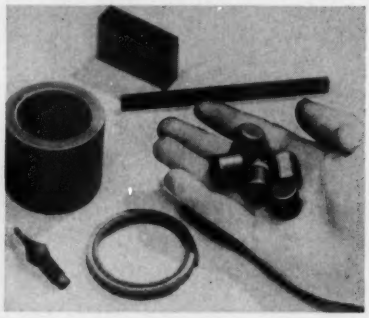
BAND SAW BLADE

Steel band saw blades are offered with wear resistant tooth tips produced by new techniques in heat treating. These blades are welded to required specifications and packaged individually for blade protection and handling ease. —**W. O. Barnes Co. Inc.**, 1297 Terminal Ave., Detroit 14, Mich.

For More Details Circle No. 474—Page 39

TITANIUM DIBORIDE

Titanium diboride maintains a flexural strength of 35,000 psi from 25° C up to 2000° C. Because it is inert to molten aluminum and zinc, although not to molten ferrous metals, titanium diboride can be used for pumps, tapping spouts, funnel linings, valves and gates with these nonferrous metals. Diamond tools are required to machine this material in fabricated form, but conventional tools can be used



during processing stages. Photo shows shapes and sizes in which it can be formed. Hardness is rated as 3300 kg per sq mm on the Knoop scale, and electrical resistivity is very low.—**National Carbon Co.**, 270 Park Ave., New York 17, N. Y.

For More Details Circle No. 475—Page 39

WHEEL DRESSING TOOLS

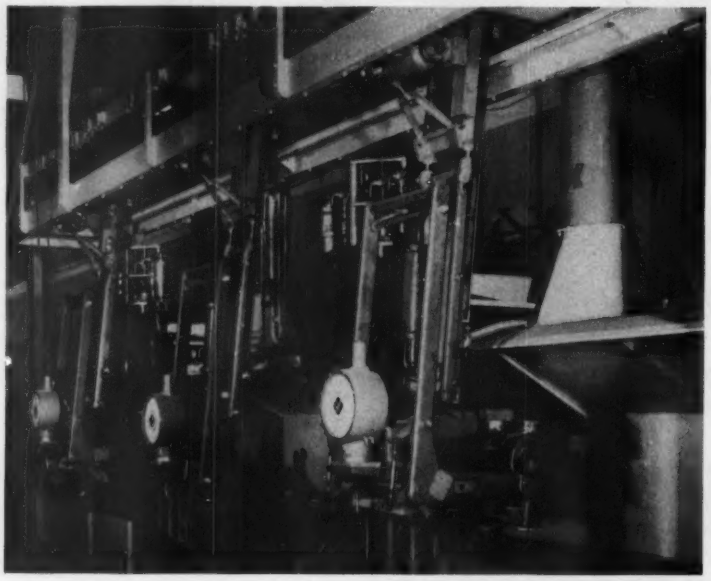
Expendable diamond dressing tools are available for dressing grinding wheels. Single-point diamonds used in these tools are said to allow maximum number of wheel dressings per tool. Resetting is eliminated, and the used diamonds can be turned in for salvage value.—**Diamond Tool Research Co.**, 380 Second Ave.. New York 10. N. Y.

For More Details Circle No. 476—Page 39

EPOXY ADHESIVE

Resin 533A is a two-component epoxy adhesive that can be cured at room temperature to provide high bend strength. It meets MIL-A-8623, Type II, specification and is furnished as a solvent-free, nonvolatile, medium-thick paste with 2-hr pot life. Material is intended to join to-

System Automatically Pours Ferrous Castings



Automatic pouring system has been developed for conveyorized, high-production ferrous foundries. The system can be adapted to either a continuous or an indexing-type mold conveyor. One man monitors an entire installation consisting of one to four pouring carriages capable of pouring as many as 400 molds per hour.

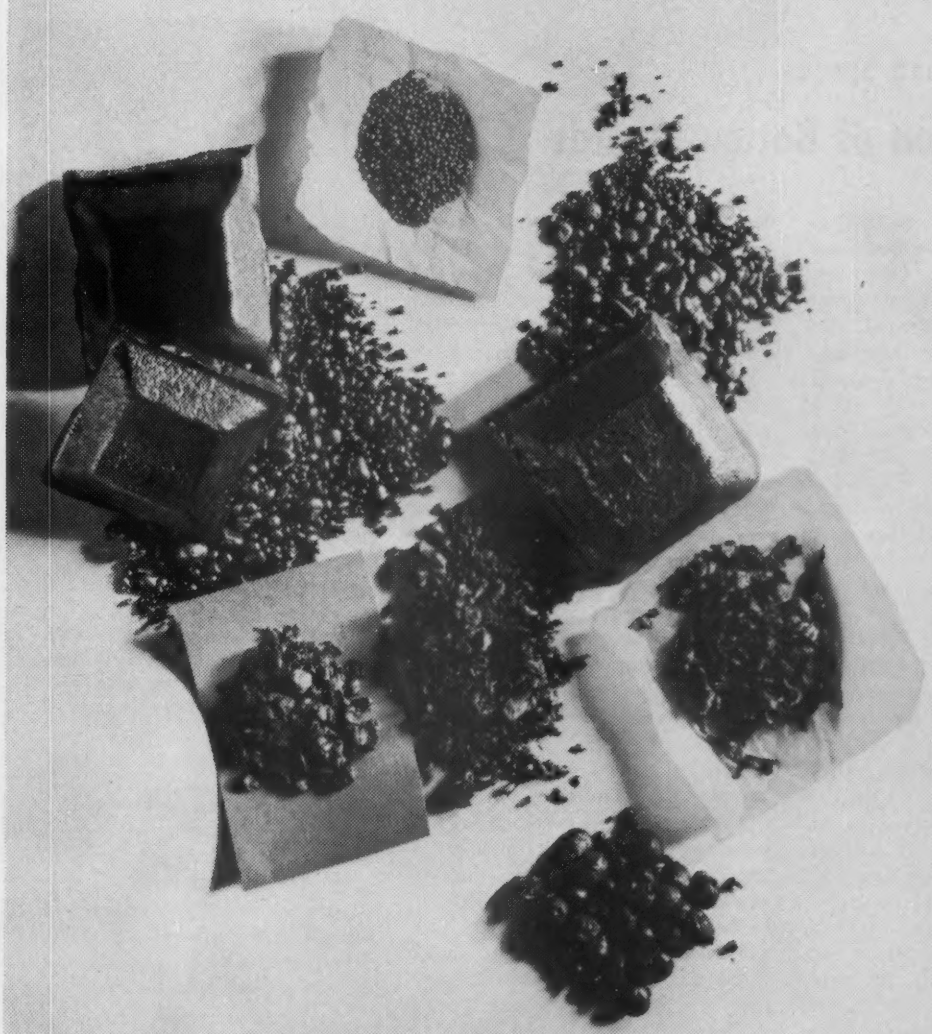
Hot metal is transferred to the holding ladle in a conventional bull ladle. The holding ladle dispenses a weighed amount of metal, sufficient for one mold, to the pouring ladle. Pouring ladle carriage engages a drag chain which moves it at conveyor speed. The pouring ladle tilts about an axis near the pouring lip to pour. When empty, it tilts back, disengages the chain, and returns to be refilled. Entire sequence is automated by a program cycler driven from the mold conveyor.—**International Automation Corp.**, 121 Huron View, Ann Arbor, Mich.

For More Details Circle No. 483—Page 39

Are you using these "hardeners" to reduce your alloying cost?

Aluminum, Arsenical Copper, Chromium Copper, Copper-Nickel Shot, Manganese Copper, Silicon Copper, Titanium Aluminum, Copper Magnesium, Copper Shot, Cadmium Copper, Copper Iron, Phosphor Copper, Aluminum Copper are produced for your convenience and will provide considerable savings in your alloying cost. Federated offers a wide range of "hardener" additives, all produced by the well known Asarco quality-controlled processes that hold impurities to the absolute minimum, and maintain a degree of uniformity unexcelled in the industry. There's a Federated Sales Office near you to give you prompt service and complete working data. Federated Metals Division, 120 Broadway, New York 5. In Canada: Federated Metals Canada, Ltd., Toronto and Montreal.

FEDERATED METALS DIVISION OF



ASARCO

AMERICAN SMELTING AND REFINING COMPANY

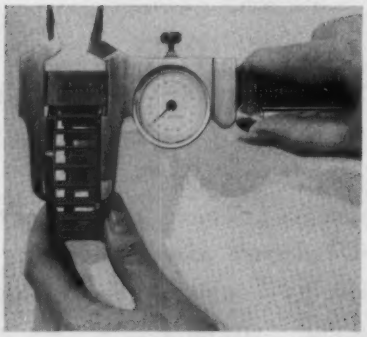
Circle 599 on Page 39

gether aluminum, steel, brass, copper, magnesium, and combinations of these metals, plus wood, glass, rubber, and some plastics. Tensile strength is claimed to be 8300 psi and hardness 83 Shore D.—**Marblette Corp.**, 37-31 30th St., Long Island City 1, N. Y.

For More Details Circle No. 477—Page 39

DIAL VERNIER CALIPER

Caliper is designed with dial vernier scale which permits direct measurement readings accurate to 0.001 in. Unit is available in four sizes which measure 0 to 6 in., 0 to 8 in., 0 to 12 in., and 0 to 24 in. Each is equipped with internal knife jaws



to measure holes as small as 0.040 in. and external knife jaws to measure grooves and recessed surfaces. All models are similar to the 6-in. model shown in the photo and are constructed of stainless steel and brass with all operating components enclosed.—**Tital Tool Supply Co.**, 1419 Hertel Ave., Buffalo 16, N. Y.

For More Details Circle No. 478—Page 39

CAN LID CLIPS

Clips are designed in three sizes to fit all types of cans from half-pint to gallon size. Each clip has five gripping points and is adjustable to handle variations in bridge widths. Clips are manufactured to tolerances of 0.005 in. and are claimed to meet postal and air mail requirements.—**Sealwall Co.**, 1936 Lake Ave., Elyria, Ohio.

For More Details Circle No. 479—Page 39

Power Nailing Speeds

Fabrication of Bottom Boards

● A SWITCH from manual to power nailing of bottom boards at Unitcast Corp., Toledo, Ohio, has paid dividends which include faster production, lower labor and material costs, and safer working conditions. Unitcast is a large producer of steel castings.

Bottom boards are fabricated from fir or spruce lumber 2 in. thick and 6 in. or more wide. Personnel of the department which makes them used to consist of two men, with as many as four assigned to the job when the workload was heavy.

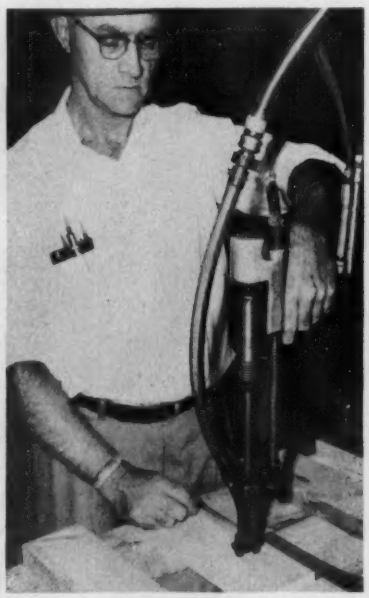
Pieces of lumber were cut to the required length and nailed together by hand with 20d nails—actually small spikes. Driving these fasteners through 4 in. of wood took six or eight powerful hammer blows. As the points emerged from the back, they were turned over or clinched by the steel work surface.

One Man Does Job—More recently, through the use of a portable automatic nailer, the operation has been mechanized and speeded up so that one man easily produces enough boards to keep up with the heaviest production schedule. This unit, manufactured by United Shoe Machinery Corp., Boston, is an air-driven machine which automatically feeds and drives nails many times faster than was possible with the manual method.

Nails are dumped in bulk into the machine's feeder unit, which automatically aligns them, point first. It feeds the nails, one at a time, through a lightweight, transparent hose to the gun, suspended over the work by a counterweight device designed at Unitcast.

The operator presses the nose of the tool firmly against the work surface and squeezes the trigger. A nail is driven almost instantly with a series of rapid blows and is countersunk to a preset depth. The rapid insertion results in a clean clinch on the reverse side and minimizes any tendency to split or crack the wood.

Smaller Nails Used—In addition to speeding production and reducing labor costs, the automatic nailer permits use of 16d nails in place of the 20d size. This saving is made possible because the machine countersinks each nail to exactly the same depth while clinching it tightly on the other side. In hand nailing, it is impractical to countersink a nail which must be clinched because it would be necessary to use a nailset. Thus hand nailing required the longer nail.



Operator presses the nailer against a bottom board and pulls the trigger to drive and countersink a 16-penny nail

Safer Working Conditions—Automatic nailing also provides greater safety. The operator is in no danger of incurring a smashed finger or thumb or of cutting or scratching himself. Furthermore, the machine never sends a nail flying across the room as a bad hammer blow may.

Finally, waste and spillage have been reduced, too, because bent or dropped nails are eliminated by use of the nailing unit.

For More Details Circle No. 484—Page 39

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Restore Costly Copper Components to Full Efficiency

AT A FRACTION OF REPLACEMENT COST!

ELECTRODE HOLDERS
BUS TUBES
CABLE CLAMPS
TUYERES

Foundry operators can now save thousands of dollars annually . . . dollars normally spent to replace costly copper components. Wilson Welding Company's patented process of restoring badly burned, pitted or scarred copper units to original specifications, or modified to meet your requirements, is guaranteed to perform and give life expectancy equal to that of new components.

The cost? Wilson prices are based upon amount of labor and material involved but rarely equal 50 per cent of replacement cost.

Wilson's prompt service reduces costly down time, since a representative job is completed and shipped within five days after receipt . . . and in less time for emergencies.

Don't discard or scrap salvageable copper components. Restore them to full efficiency at a fraction of replacement cost. Write or call Wilson Welding Company, Inc. for cost estimate or additional information without obligation.

These two views of the same electrode holder show the badly burned and pitted condition in which it was received, and its appearance after restoration to original specifications by Wilson Welding's unique, exclusive process. This holder was shipped within five days after receipt at a cost less than half that of a new unit.

WILSON WELDING COMPANY, INC.
COPPER AND COPPER ALLOY WELDING
Now serving 300 steel mills and foundries throughout the United States and Canada

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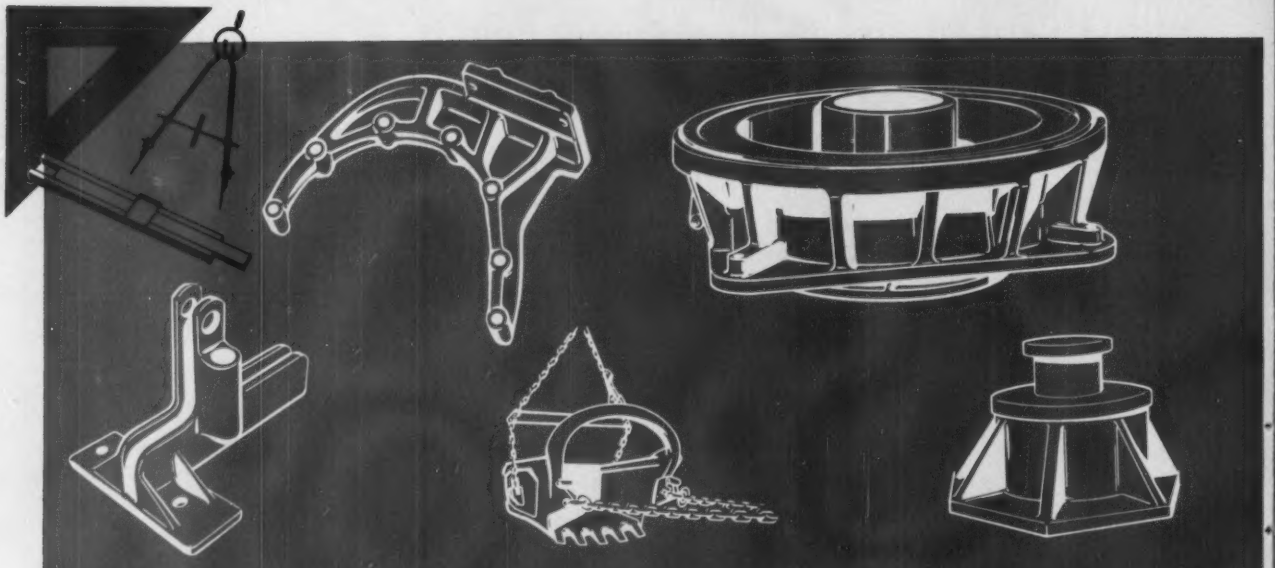


How Designers Look at . . .

Future Use of Castings

A survey of design engineers in chief casting consuming industries shows that use of castings of all types will increase 22 per cent by 1965. Casting quality, uniformity, and delivery are criticized

● BY 1965, use of castings of all types will have increased an average of 22 per cent over the 1959 level, according to a survey of design engineers conducted by the market research department of FOUNDRY.

Questionnaires were sent to 4796 chief design engineers in more than 20 industries which are the chief users of castings. Those returned totaled 1030, or about 21 per cent.

Industries surveyed included producers of agricultural equipment; heating and cooking equipment; construction and mining machinery; oil field machinery; machine tools; metalworking machinery; textile machinery; paper industry machinery; special industrial machinery; pumps and compressors; industrial trucks and tractors; power transmission equipment; refrigeration machinery; valves and fittings; wiring devices; motors and generators; electrical appliances; aircraft; railroad equipment; and a number of others.

Table I lists these industries by number of questionnaires returned, current annual use of castings by reporting companies, and per cent of increase expected by 1965. Table II shows expected increases in the use of castings by types of metal. No figures for malleable iron are shown in Table II because the return from automotive companies, which use more than half of all malleable castings, was so small as to be inconclusive.

Essentially, the figures in these tables speak pretty much for themselves, but some high points probably should be noted.

Adequate Sample — First, the 556,221 tons of castings used annually by the respondents amounts to a respectable sample of the approximately 15,800,000 tons produced in 1959—particularly since little automotive tonnage is represented. Second, a 22 per cent increase from the 15,800,000-ton total in 1959 would mean a production of about 19,760,000 tons of castings of all types in 1965. This sort of projection is, of course, subject to economic conditions and technological change, but it serves to indicate the trend.

Ductile Iron Is First—Of the various metals, ductile iron easily came in first with a predicted increase of 67 per cent. This growth is two and one-half times that of aluminum, which was second with 27 per cent, and nearly three times that of zinc, which was third with 23 per cent. The magnitude of the percentage increase in ductile iron is so large primarily because of the

TABLE I—Current and Future Use of Castings—by Industry

Industry	Number Of Plants Reporting	Annual Casting's Use, Tons	Expected Increase By 1965, %
Agricultural Equipment	64	86,802	25%
Heating, Cooking Equipment	48	28,367	5
Construction, Mining Machinery	68	30,651	26
Oil Field Machinery	26	12,912	13
Machine Tools	67	35,499	27
Metalworking Machinery	79	48,070	14
Textile Machinery	44	27,835	25
Paper Industry Machinery	15	4,048	7
Special Industrial Machinery	91	24,611	12
Pumps, Compressors	67	58,918	22
Industrial Trucks, Tractors	15	912	12
Power Transmission Equipment	39	19,016	24
Refrigeration Machinery	50	17,040	5
Valves, Fittings	52	37,331	26
Wiring Devices	18	3,502	16
Motors, Generators	46	37,128	13
Electrical Appliances	23	5,974	35
Aircraft	82	3,546	8
Railroad Equipment	13	8,775	13
Mechanical Measuring Instruments	53	10,568	20
Miscellaneous	30	10,181	18
Automotive Parts	40	44,935	3
TOTAL	1,030	556,621	22

TABLE III—What Design Engineers Want in Castings

Fewer defects due to carelessness	22%
Better delivery (faster or on time)	16%
More quality control	16%
Closer tolerances	13%
Better finish and cleaning	12%
Lower prices	12%
More uniformity	9%
Lower pattern cost	6%
Technical advice for design engineers	4%
Guarantee of no defects after machining	4%
Better inspection	4%

Percentages add up to more than 100% because some respondents listed more than one comment

TABLE II—Expected Increase in Casting Use—by Type of Metal

Industry	Number Of Plants Reporting	Expected Increase in Consumption by 1965						
		Gray Iron	Ductile Iron	Carbon Steel	Alloy Steel	Aluminum Alloys	Copper-Base Alloys	Zinc Alloys
Agricultural Equipment	64	26%	75%	9%	..	17%	44%	34%
Heating, Cooking Equipment	48	5	..	..	..	4	31	..
Construction, Mining Machinery	68	34	35	18	19	34	2	..
Oil Field Machinery	26	5	161	14	10	25	..	..
Machine Tools	67	22	88	30	21	27	13	..
Metalworking Machinery	79	11	121	8	19	40	6	..
Textile Machinery	44	25	17	20	53	13	17	..
Paper Industry Machinery	15	7	..	10	..	14	4	..
Special Industrial Machinery	91	12	50	10	2	18	7	..
Pumps, Compressors	67	23	9	10	9	50	20	..
Industrial Trucks, Tractors	15	18	..	10	..	..	..	..
Power Transmission Equipment	39	29	15	19	10	23	25	..
Refrigeration Machinery	50	16	..	11	..	12	19	8
Valves, Fittings	52	14	3,000	20	23	40	27	16
Wiring Devices	18	..	..	..	..	11	7	..
Motors, Generators	46	12	19	..	..	20	12	47
Electrical Appliances	23	10	..	..	..	34	..	53
Aircraft	82	5	8	5	26	15	1	—8
Railroad Equipment	13	7	4	10	..	..	6	..
Mechanical Measuring Instruments	53	27	..	26	26	40	18	..
Miscellaneous	30	19	122	..	..	5	25	13
Automotive Parts	40	..	3	..	..	17	2	22
AVERAGE INCREASE	1,030	18	67	16	17	27	16	23

relatively small tonnage now being poured (169,000 tons in 1959).

Bases of Increase—The design engineers surveyed also were asked to list the reasons for any changes in the use of castings that they might foresee. Over-all, the chief reason unquestionably was simply economic growth—that is, increased business and development of new products. In addition, however, many mentioned conversions from other forms of fabrication, such as weldments and forgings, although this sort of switch was by no means a one-way street; many engineers mentioned the possibility of conversions *from* castings.

Other reasons included taking advantage of the flexibility and economy of the casting process, eliminating machining, achieving more efficient operation through the use of castings, and using new developments in foundry technology.

In addition, the design engineers were asked the following: "Do you have any complaints about foundries and castings? What are some of the things which foundrymen must do to get more castings specified for use in products?"

The Complaints—Of the 1030 respondents, 192—or about 19 per cent—took advantage of this opportunity. A small number—specifically, 7 per cent—expressed satisfaction with their casting suppliers and their products. To what extent this group represents the 81 per cent who did not comment is a matter of conjecture. In any event, only 12 per cent of the 1030 respondents had specific criticisms.

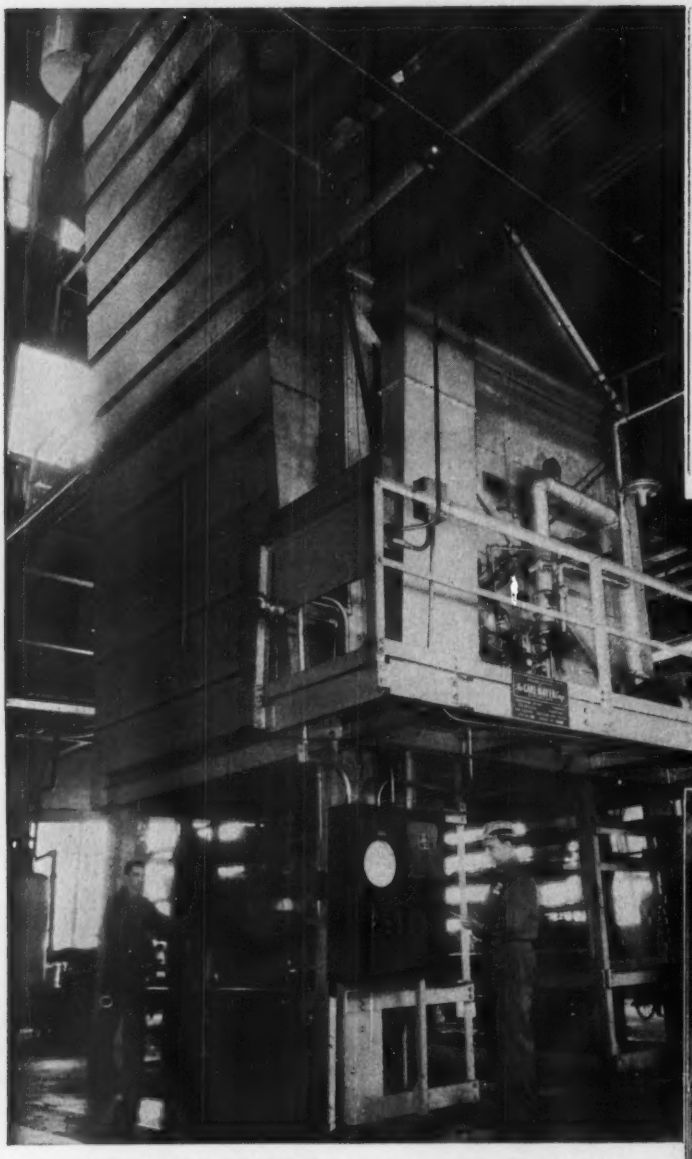
That 12 per cent listed a variety of beefs which boiled down pretty much to three areas—quality, delivery, and cost, with overwhelming emphasis on quality. An accompanying table shows a breakdown of these complaints in categories patterned after the engineers' terminology. The factor of quality shows up in most of them in a variety of forms.

One point seems clear from this breakdown: Impressive and comforting as the predicted 22 per cent increase is, it's no cause for complacency. The increase obviously could have been greater, and it still can be less.

Basically, all the foundryman has to do is to make better castings consistently, and to deliver them on time. The market exists, but it isn't private property. Any other form of fabrication can take it away by making parts better, faster, or cheaper—but primarily by making them better.

Foundry-Proven Money Makers!

Ovens Designed by carl mayer CORP.

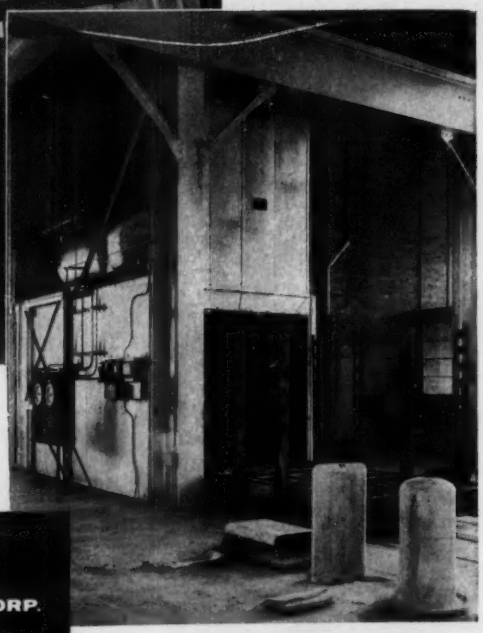


The Carl Mayer Corp. experience in engineering and designing industrial ovens and furnaces is second to none! Carl Mayer ovens incorporate recirculating heating systems with sealed combustion chambers and automatic temperature controls for all fuels. Cores and molds are evenly baked faster, with less fuel consumption.

Many foundries of all sizes have found it pays to install Carl Mayer ovens—Our engineers will be glad to work with you on your oven problems. Write or call now!

Write for Bulletin 53-CM

A NEW VERTICAL CORE OVEN Installed at Forest City Foundry, Cleveland, Ohio. Size is 12' 7" x 11' 10" x 57' 8" high above floor. 29 carriers, 3 shelves high; each shelf 30 x 106 inches. Features forced cooling and exhaust system for uniform cooling of cores before unloading.



CAR TYPE MOLD OVEN at American Brake Shoe Co. features under floor chain car puller. Size 10' x 10' x 19' long.

THE **carl mayer** CORP.

20800 CENTER RIDGE ROAD CLEVELAND 16, OHIO

OTHER PRODUCTS: Heat Treating Ovens and Furnaces • Rod Bakers • Welding Rod Ovens • Paint and Ceramic Drying Ovens • Special Processing Equipment and Accessories

INDUSTRY BRIEFS...

Wellman Bronze & Aluminum Co., Cleveland, has leased the Dow Chemical Co. sand and permanent mold foundry in Bay City, Mich. Dow states this move, like the closing of its diecasting department in Bay City earlier, was made to remove the company from competition with foundries which are customers for magnesium ingot. The Bay City foundry employs about 400 persons and is expected to continue operating with present personnel. The fabrication department of the Bay City plant is not affected.

Lynchburg Foundry Co., Lynchburg, Va., is constructing a $37,550, two-story addition to increase the capacity of its shell molding foundry. The addition is scheduled for completion in March. No increase in employment is expected in the near future as a result of the addition.

Humble Oil & Refining Co. has reorganized its Penola Division. Name of the section handling direct marketing of products which include core oils and carbon sands has been changed to Humble Oil & Refining Co. Service and representation are unchanged but product brand names are being changed from Penola to Humble. The original Penola Division will handle wholesale marketing only.

Harry Blumenthal Co. has been formed with office and warehouse at 304 First St., Minneapolis. It will act as sales agent and buyer in aluminum, brass, bronze, and zinc base alloys for foundries and diecasters in the upper Midwest.

Hapman Corp., Kalamazoo, Mich., has acquired Econ-O-Veyor Corp., Glen Cove, N. Y., with the approval of 86 per cent of the Econ-O-Veyor stockholders, and manufacturing facilities of Econ-O-Veyor will be moved to Kalamazoo. John Leach, former president of Econ-O-Veyor, has become vice president in charge of the Econ-O-Veyor division.

Kaiser Refractories & Chemicals Div., Kaiser Aluminum & Chemical Corp., has moved its Toledo, Ohio, warehouse and sales offices to 2031 Detroit Ave.

Simonds Saw & Steel Co. has opened a southern California branch warehouse, sales office, and service shop at 1950 E. 20th St., Los Angeles, for southern California, Arizona, southern Nevada, New Mexico, and the El Paso area of Texas. It will be a combined facility for Simonds subsidiaries, Simonds Abrasive Co. and Heller Tool Co., as well as for the parent company.

American Brake Shoe Co., New York has purchased Dynisco Inc., Cambridge, Mass., a manufacturer of electro-mechanical transducers and ultrasensitive measuring instruments. The new subsidiary will remain at Cambridge and be operated by its present management as a division of American Brake Shoe.

Industrial Heating Equipment Association Inc., reports that new orders for industrial heating equipment in November totaled $5,084,000, down 23 per cent from October orders. November orders for induction heating equipment were $1,357,000, up 114 per cent.

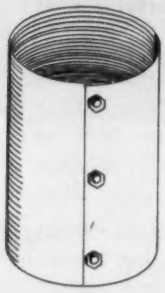
Sternaman Foundry Inc., 1101 Dorlan St., Springfield, Ill., an aluminum foundry, is going out of business.

Baird-Atomic Inc., Cambridge, Mass., has acquired a major share of stock of Electronisch Kernfysisch Apparatenfabriek N. V., The

SAFETY CITATION: Superior Foundry Inc., Cleveland, was cited recently for having the fewest lost-time accidents between April 1 and Sept. 30 for Cleveland foundries employing 201 to 500. The award was made by the Industrial Commission of Ohio, division of Safety & Hygiene, and the Cleveland Safety Council. Above, the plant safety committee looks over the citation with Albert L. Hunt, executive vice president. Left to right, seated, are James Sims; Mr. Hunt; LeRoy Payne; and Harold Wheeler, director of the safety program. Standing, from left to right, are James Knize, Jesse Payne, Willie Williams, William Nowak, and Allen McLaughlin

HOW TO DO IT

By H. B. DIETER
D & H Foundry
Austin, Texas



Wrap-around Coreboxes for Cylindrical Cores are Made from Sheet Metal

INEXPENSIVE coreboxes can be made for producing cylindrical CO_2 cores if conventional wood or metal boxes of the proper size are not available. A sheet of metal is cut so that its width equals the height of the desired core. Its length should be 1 in. longer than the circumference of the core (3.14 times the core diameter).

All dimensions must be adjusted to allow for normal casting shrinkage. The sheet is rolled in a tinsmith's roll or bent by hand to form a cylinder with the correct diameter. This tube is clamped at the overlapping seam so that holes can be drilled for short bolts.

When the corebox has been assembled as shown, a core can be rammed with sodium-silicate-bonded sand and cured with CO_2. The core is removed by loosening the nuts and unwrapping the corebox. This method is particularly useful when making small quantities of special bushings requiring cores from 2 to 10 in. in diam.

Have any ideas of your own? FOUNDRY will pay a minimum of $15 for each "How To Do It" item submitted and published

Hague, Holland, a nuclear instrument company. The Dutch company will be known as Baird-Atomic Holland N. V. Baird-Atomic also has acquired a manufacturing plant in Waltham, Mass., with 40,000 sq ft to house its defense contract activities.

Osborn Mfg. Co., Cleveland, has appointed Cooper-Chapman Ltd., Weston, Toronto, Ont., exclusive Canadian representative for its foundry production equipment.

Curtis Mfg. Co., Pneumatic Div., St. Louis, has appointed Roland S. Boreham Co., 1206 Maple Ave., Los Angeles, sales representative in southern California, Arizona, and parts of Nevada for industrial air compressors, air tanks and fittings, air hoists, air power cylinders, and I-beam trolleys.

Harcast Co., Glenolden, Pa., has acquired Precision-Cast Products Co., Philadelphia. Both are investment casting foundries.

Heil Co., Milwaukee, has acquired the material handling equipment business of Ingersoll Kalamazoo Div., Borg-Warner Corp., Kalamazoo, Mich. Machinery and fixtures used in production of the material handling equipment will be moved from Kalamazoo to Heil's main plant in Milwaukee and will be operated as part of the firm's Body and Hoist Div.

Temescal Metallurgical Corp. has moved its offices and plant from Richmond, Calif., to 2850 Seventh St., Berkeley, Calif. A new electron beam furnace is under construction at the Berkeley site to produce refractory metals.

Thermal Ceramics Industries Inc., Denver, has acquired Denver Fire Clay Co., Denver, manufacturer of fire brick, heavy refractories, industrial furnaces, heating equipment, and other products. Richard Shepard, president of Denver Fire Clay, will continue in that capacity and also serve as board chairman. Gerald W. Jensen has been appointed executive vice president and treasurer.

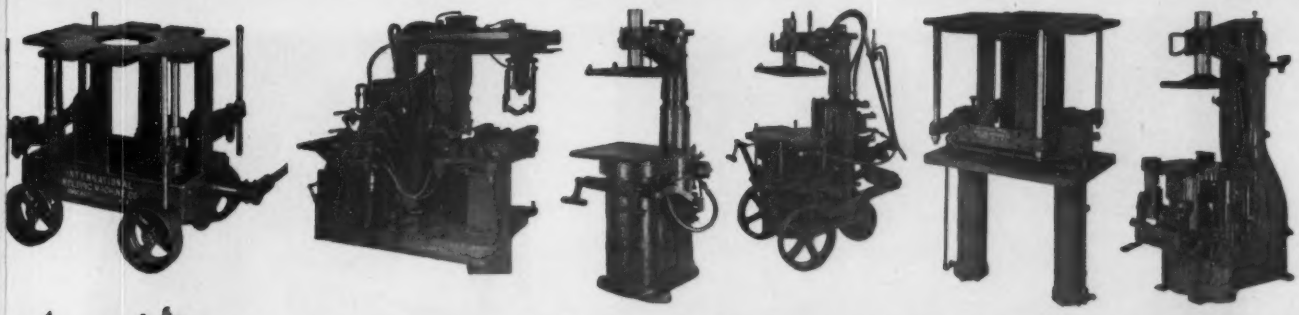
"Have a bad day in the sand traps last weekend?"

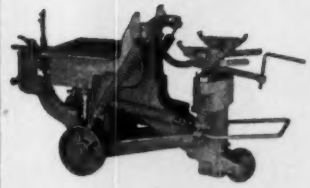
Alloy Steel Casting Co. has begun construction of an addition at its Southampton, Pa., plant. The new building will house investment casting facilities. Donald J. Volk is president.

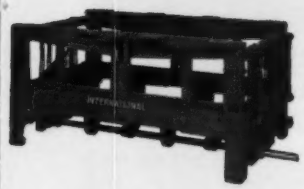
Cerro de Pasco Corp., 300 Park Ave., New York, has changed its name to Cerro Corp. The company and its subsidiaries produce and fabricate nonferrous metals.

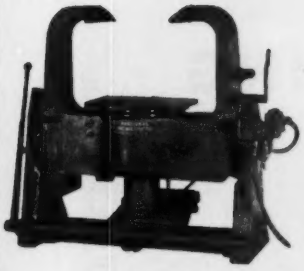
Newton-New Haven Co., New Haven, Conn., producer of zinc and aluminum diecastings, has appointed Hilker Co., Winston-Salem, N. C., sales representative in North Carolina, South Carolina, eastern Tennessee, and Virginia.

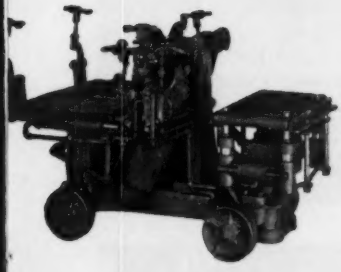
General Refractories Co., Philadelphia, has appointed Sussman Asbestos Co., 436-42 Thirteenth St., Toledo, Ohio, to be a distributor of its refractories.

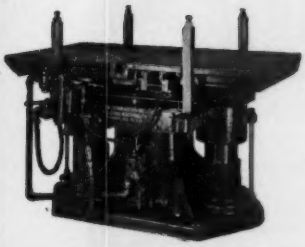


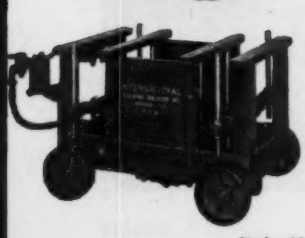












Foundrymen....

NOW is the time to REBUILD your FOUNDRY MACHINES

We're ready to put your equipment in top shape as you get set for the boom that is on the way.

Our excellent facilities give you many distinctive advantages:

- **"Know-how" of original manufacturer**
- **Genuine replacement parts**
- **Regular guarantee on all parts replaced**
- **All rebuilding and repairs done by factory-trained experienced men.**

International rebuilding service means longer life for your present equipment and assurance of top performance in use.

You can depend on...

INTERNATIONAL

MOLDING MACHINE CO.

LA GRANGE PARK, ILLINOIS

Write, wire or call today.

Alert Foundrymen are REBUILDING for the BOOM!

Gentlemen:
We are interested in having the following machines rebuilt:

_____

_____

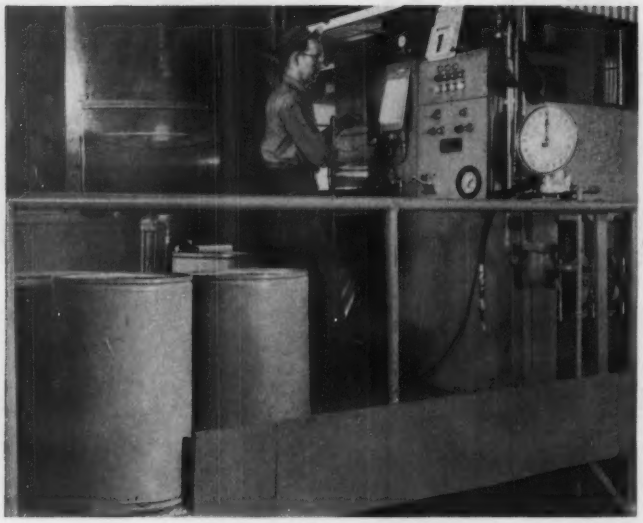
NAME _____ **TITLE** _____

COMPANY _____

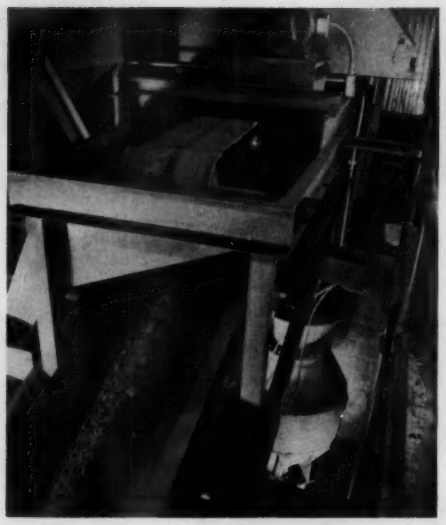
ADDRESS _____

CITY _____ **ZONE** ____ **STATE** _____

Circle 602 on Page 39



Measuring, mixing, and distribution of molding sand is controlled from this master panel



This sand is about to be screened before it reaches transporter, visible below the floor

New Facilities Include

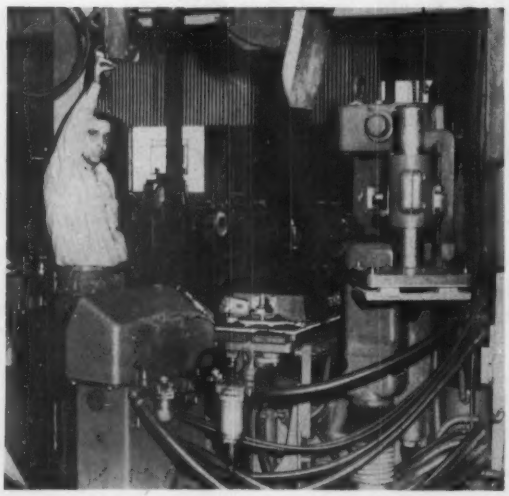
MODERN SAND HANDLING

● TO MARK the start of its second year in a new, modern plant, St. Paul Brass Foundry Co., St. Paul, held a two-day open house recently. Guests took a step-by-step tour as they watched the production of a souvenir aluminum ashtray, and more than 300 persons attended during the two days.

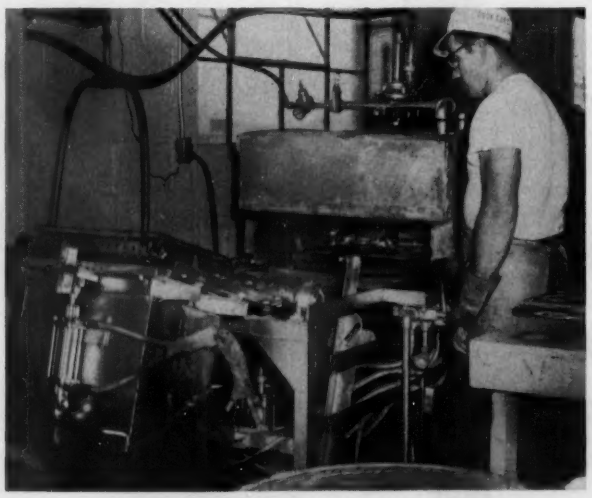
The present plant is the company's fourth. It replaces one which was torn down to make way for a part of the St. Paul interstate freeway system. The new building is 108 x 150 ft and contains more than 20,000 sq ft of space on two floors. Total cost of the building and equipment was in excess of $400,000.

Sand Handling—A feature of the new facilities is a modern sand handling system designed to send sand to any molding station in the plant from a central control board. This system takes sand through the shakeout by conveyor to the top of the transporter and up to a 120-ton capacity overhead silo. From the silo, sand moves successively to a batch hopper, to the muller, and

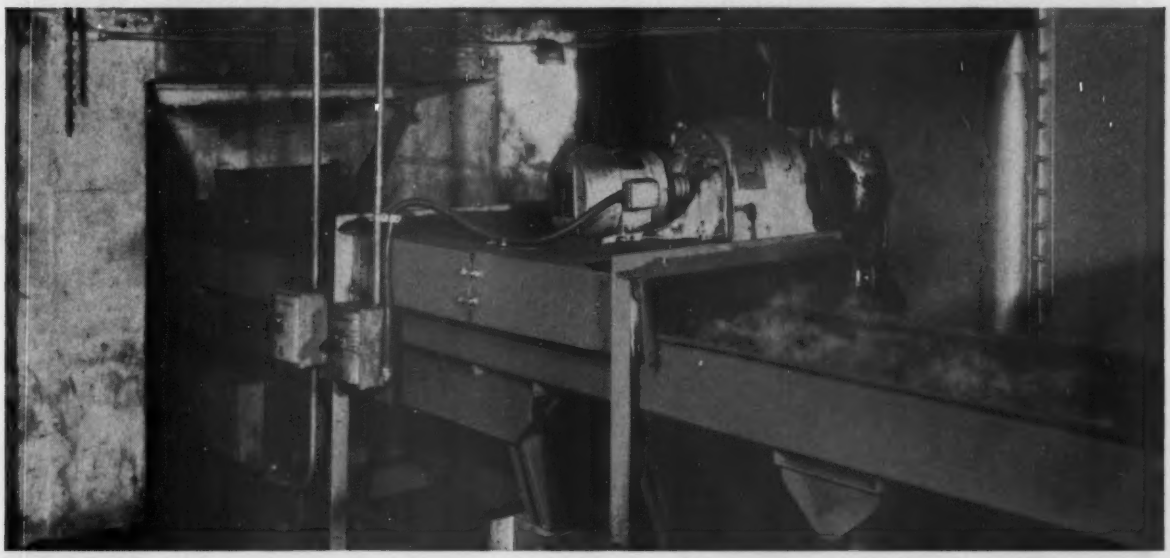
Mold copes can be turned out at a rate of 100 per hour on this semiautomatic molding unit



Two-station shell molding machine is investing one mold while another is curing in the oven



At Caterpillar Tractor Co.'s foundry in Peoria, Illinois, molds are carried on a Jeffrey mold conveyor, an endless loop of smooth riding cars. Rugged construction assures a minimum of maintenance. Below the foundry floor, Jeffrey MV vibrating conveyors carry sand from shakeout to the reconditioning plant.



"OUR LONG RANGE FOUNDRY PROGRAM IS GEARED TO IMPROVE THE QUALITY OF CATERPILLAR CASTINGS, PROVIDE BETTER WORKING CONDITIONS AND UTILIZE THE LATEST AND BEST PRODUCTION TECHNIQUES."

Caterpillar Tractor Co.

Constant improvement in methods and equipment have keynoted Caterpillar's determination to keep its foundry among the best and most modern—a reputation established thirty years ago, when this foundry first began operation. Jeffrey equipment has played, and continues to have, an important part in this program. The Jeffrey Manufacturing Company, 907 North Fourth Street, Columbus 16, Ohio.

CONVEYING • PROCESSING • MINING EQUIPMENT...
TRANSMISSION MACHINERY...CONTRACT MANUFACTURING

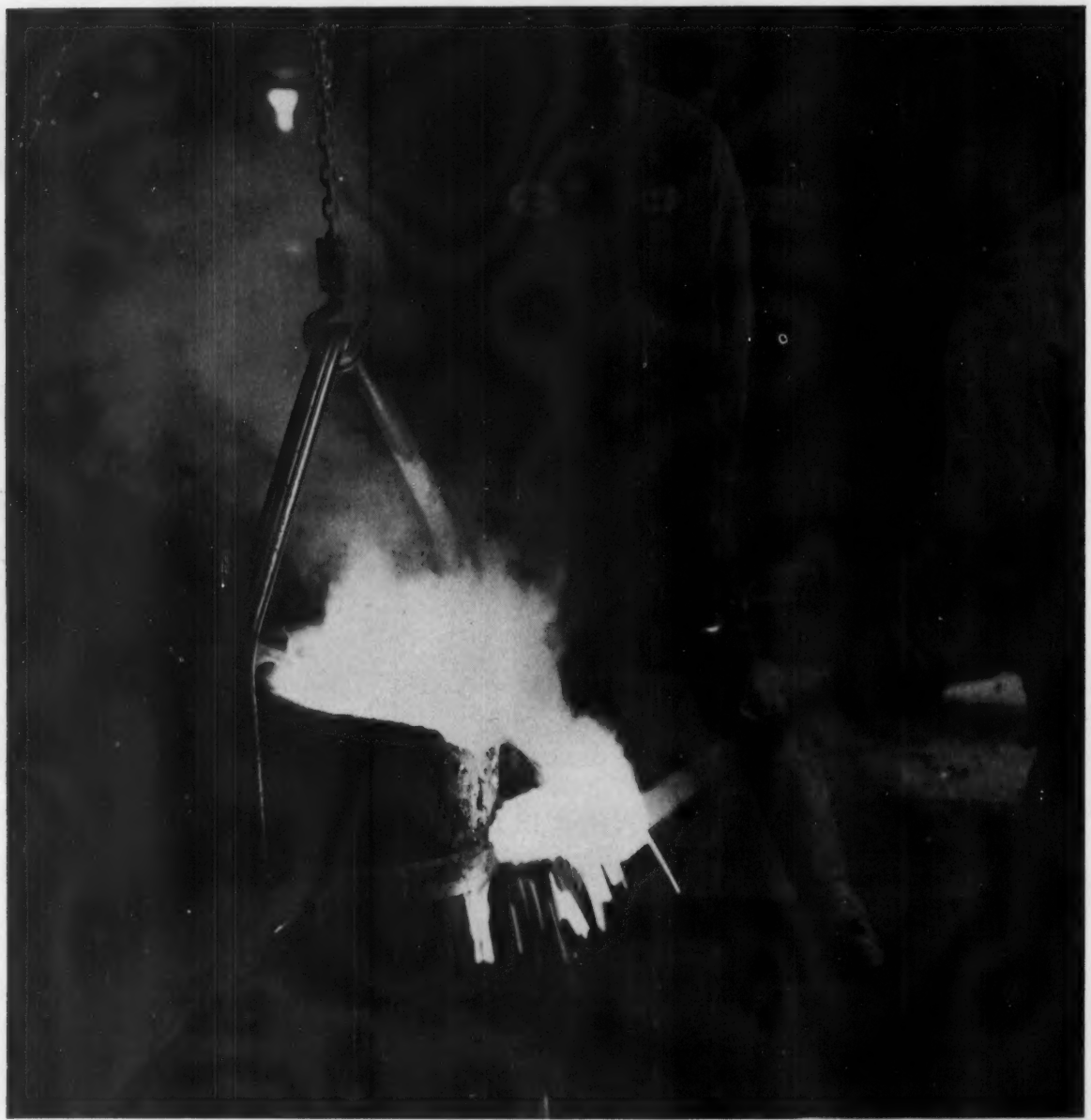
JEFFREY

Circle 603 on Page 39

YOUR KEY to Better, Cleaner Brass Castings...

Famous CORNELL
BRONZE & BRASS FLUX

- Cleanses molten brass whether red or yellow even when the dirtiest brass turnings or sweepings are used.
- Longer crucible life — no metal loss.
- Forms a perfect covering over the metal during melting, prevents oxidation and reduces obnoxious gases to a great extent.
- Write or call for full information.



The CLEVELAND FLUX Company

1026-40 MAIN AVENUE, N. W. • CLEVELAND 13, OHIO

Manufacturers of Iron, Semi-Steel, Malleable, Brass, Bronze, Aluminum and Ladle Fluxes . . . Since 1918

FAMOUS CORNELL FLUXES

Trade Mark Registered

back to the molding stations. This system was installed by Whirl-Air-Flow Corp., Minneapolis.

Molding—The company produces castings in both green sand and shell molds. Shell molds are made on a two-station unit, and green sand molds are produced on semiautomatic cope and drag molding machines which make up to 100 molds

Trimmed castings are being loaded on table blast unit for rough cleaning

per hour. Shell cores are used, too. Completed molds are moved to the adjacent pouring area by roller conveyor.

Eight Furnaces Are Used

Copper and aluminum alloys are melted in eight furnaces of various types and capacities. Units include a reverberatory furnace with a capacity of 600 lb of brass and bronze, three tilting furnaces for brass and bronze with individual capacities of 1200 lb, three small crucible furnaces, and an aluminum dip furnace with 300-lb capacity.

Molten metal is tranferred into pouring ladles and carried by crane to the pouring floor. After molds have cooled, they are moved by conveyor to the shakeout area. Loose sand goes through a vibrating shakeout, passes through two sets of sized screens, is lifted by a belt conveyor to the top of the transporter, and returned by air pressure to the sand silo above the roof. A sand laboratory makes appropriate tests of sand properties.

Chattanooga To Be Host for Southeastern Conference

Annual Southeastern Regional Foundry Conference will be held at the Read House, Chattanooga, Tenn., Thursday and Friday, Feb. 16-17. Sponsors are the Tennessee, Birmingham District and University of Alabama student chapters of the American Foundrymen's Society.

The conference will be under the general chairmanship of Herman Bohr, past Tennessee Chapter chairman. James L. Payne, Ross-Meehan Foundries Inc., is chairman of the program committee which has arranged a program of ten technical papers. Friday morning will be devoted to plant visits.

Other features of the conference include a Friday night banquet, with Warren Whitney, James B. Clow & Sons, speaker; a ladies night dinner on Thursday; a Thursday luncheon with Harry Kessler as speaker; and a ladies luncheon and style show on Thursday.

Technical talks are the following:

"Carbon Control in Acid Melting," Wally Levi, consultant.
"Snagging and Cutoff Cost Reduction," John A. Mueller.
"Water-Cooled Cupola Operation," H. W. Schwengel, Modern Equipment Co.
"Foundry Cost Analysis," Harry Kessler, Sorbo-Mat Process Engineers.
"Common Mistakes in Foundry Ventilation," Herbert J. Weber, AFS.
"Foundry of the Future," Clyde A. Sanders, American Colloid Co.
"Aluminum Risering, Feeding, Degassing," Donald Wyman, Exomet Inc.
"Core and Mold Blowing," Lawrence D. Pridmore, International Molding Machine Co.
"Sand Reclamation," C. T. Jones, National Engineering Co.
"New Developments in Green Sand Molding," Tom Barlow, International Minerals & Chemical Corp.

American Firm Will Produce Italian Induction Furnaces

Under a licensing agreement with Calamari & Co., Milan, Italy, an American firm has been formed to manufacture and distribute several models of low-frequency induction furnaces. The new firm is Calamari Electro-Induction Furnace & Equipment Co., division of DaPrato Mfg. Co., 58 Industrial Rd., Addison, Ill.

Four basic types of low frequency induction furnaces will be produced. Capacities will range from 50 lb to several tons per hour. Series G. R. is expected to be of most interest to American foundrymen. It has a barrel design and is useful for applications in which superheating is required up to a temperature of 3250° F.

Advantages claimed for this furnace include long refractory life and comparatively high power factor. The refractory is a sintered magnasite imported from Germany. The furnace power factor ranges from 65 to 72. Three-phase power supply is used. The barrel design features end-loading and a water-cooled jacket.

Book Review

Fundamentals of Steel Foundry Sands, **edited by Charles W. Briggs, cloth, 152 pages, 5½ x 8½ in., published by the Steel Founders' Society of America, Cleveland. Price $4.**

This book contains six lectures presented at the 1959 Technical and Operating Conference of the society by authorities on sands and clays used to produce steel castings. These lectures summarize the numerous studies conducted on sands, binders, and molds during the last decade and consolidate the information for study by both operating and technical men.

First lecture, "Characteristics of Sand," is by John F. Wallace. It discusses mineralogy, physical properties, grain shape, grading and segregation, and properties of water-sand mixes.

"Constitution and Significance of Clays and Bentonite," by Willis G. Lawrence, deals with structure of clays, base-exchange properties, classification and property characteristics, and clay-sand bonds.

"Essentiality of Water Additions," by William D. Emmett, relates to sand-clay-water mixes, moisture control, and relation of water content to mold defects.

"Qualities of Organic Bonding Materials," by Victor E. Zang, discusses organic bonds and their influence on mold properties, shell molds, and advantages and disadvantages of organic additions.

"Mulling and Shaping of Molding Sands," by John A. Rassenfoss, deals with bond distribution, plasticity, packing and grading of sand, sand flow under pressure, and mold hardness distribution.

"Effect of Molten Steel on Sands and Molds," by Charles W. Briggs, is concerned with physical changes in sand and clays, mold durability, gas evolution, casting defects, mold surface failures, and mold-steel interface reactions.

In Sand Reclamation

PNEU-RECLAIM HAS 50%

It's Output That Counts

GREATER SCRUBBING CAPACITY

From B & P RESEARCH

In Comparative Testing, PNEU-RECLAIM Has Been Proved To Have Up To 50% Greater Scrubbing Capacity Than Like-Size, Like-Purpose Machines.

Only when research and development are combined with practical testing and proving can breakthroughs in production efficiency be attained. In continuing work at the Beardsley & Piper Technical Center, B & P engineers have achieved just such a breakthrough. Pneu-Reclaim, the world's leading sand reclamation unit, has undergone design changes which have resulted in even further simplification of operation. But most important of all, these design changes have increased Pneu-Reclaim efficiency to where output capacities (based on the same percentage of clay removal) are now 50% greater than ever before . . . and certainly far greater than any other comparable unit in today's market.

These capacity figures are not just research estimates. They have been substantiated by repeated reclamation of representative sands from numerous leading foundries throughout the country—and B & P stands ready to further verify these results by processing a representative amount of your sand and returning it to your foundry for shop tests in cores and molds —you can be confident of B & P foundry proved performance.

Lower Initial Cost

Pneu-Reclaim's increased output can mean lower initial cost for your sand reclamation system. If you have had a previous reclamation survey indicating a certain sized reclamation unit is required, the newly designed, higher capacity Pneu-Reclaim may allow you to enjoy the cost-cutting advantages of sand reclamation with a smaller unit. Call in your Beardsley and Piper sales representative and have him recheck your needs as dictated by the new, higher capacity Pneu-Reclaim. His short visit can mean greater savings for your foundry operation.

BEARDSLEY & PIPER
Div. Pettibone Mulliken Corp.
2424 N. Cicero Ave., Chicago 39, Ill.

MEMBER FEMA

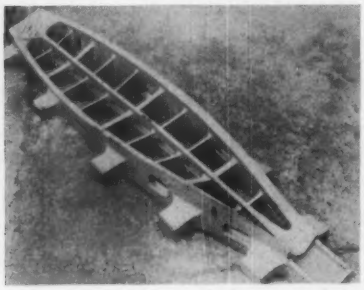
Circle 606 on Page 39

..FOUNDRY DEVELOPMENTS

By EDWIN BREMER
Metallurgical Editor

Withstands the Heat

STAINLESS steel casting shown in the accompanying illustration plays an important part in production of aircraft propellers for propjet engines at Allison Div., General Motors Corp., Dayton, Ohio. The fixture, weighing about 400 lb, carries the propeller during brazing operations. Treatment includes pre-



heating at 1650° F for two hours, the brazing operation at 2060° F for one hour in a controlled atmosphere, rapid cooling to 600° in two hours, and then air cooling. The steel is Alloy Casting Institute designation type HN containing 25 per cent nickel and 20 per cent chromium.

Screens Flowing Metal

EXPERIMENTAL work on "Flow of Metal Through Screens" by Birch and Llewelyn is described in the Nov. 24, 1960, issue of *Foundry Trade Journal* (London, England). According to the authors, the metal flow pattern may be with initial penetration of the screen and a nonuniform flow through the screen, or with no initial penetration and a uniform flow through the screen.

An ideal pattern would be uniform flow with minimum turbulence and exposed metal. To achieve that it would be preferable to place the screens as far from the sprue base as possible or to use a ball of wire-wool in the sprue side of the well.

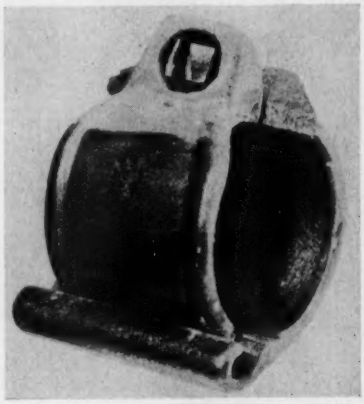
The buildup at the screen undoubtedly is beneficial since it insures that the runner system is full to the height of the screen well, from the sprue to the screen.

Reduces Hot Tearing

INCIDENCE and severity of hot tearing in white iron castings decreases as grain size decreases, and additions of as little as 0.02 per cent Ti achieved a considerable effect. Larger additions have progressively less effect on grain size but reduce the tendency to hot tearing still further. These conclusions resulted from an investigation carried out by M. D. Twitty and described in "Influence of Grain Size and Stripping Time on the Incidence of Hot Tearing in White Iron Castings," published in the November, 1960, issue of *BCIRA Journal* (Birmingham, England). It also was found that the longer the castings are left in the mold before stripping, the less severe is hot tearing.

Weight Is Reduced

REDESIGN program by M. B. Skinner Co. and its malleable iron supplier, Dalton Foundries Inc., resulted in the much lighter pipe repair clamp shown in the accompanying illustration. Critical areas in the previous heavier design were determined by stress analysis. Needless metal was eliminated and, to achieve thinner sections, a system of internal runners was used in feeding hot metal rapidly into the mold cavity.



The change resulted in a 60 per cent reduction in weight and a more favorable price as well as a 12 per cent cost saving in material. The lighter weight permits shipping the clamps in pairs at a lower cost than for one of the former parts.

Cast Aluminum Approaches 50,000 psi Tensile

A tensile strength of 50,000 psi on standard aluminum casting alloys is being approached by Precision Metalsmiths Inc., Cleveland, producer of investment castings.

An ultimate tensile strength of 49,500 psi with 3 per cent elongation per 1 in. gage length has been obtained with investment-cast 355 standard aluminum alloy in the T7 condition. Typical tensile strength is 45,000 psi with 4 per cent elongation.

Standard 356 aluminum alloy has been investment-cast with ultimate tensile strength of 44,000 psi and 8½ per cent elongation per 1 in. gage length in the T6 condition. Typical tensile strength is 40,000 psi with 5 per cent elongation.

Foundry engineers at Precision Metalsmiths state that consistent results are being obtained through use of the following foundry techniques:

1. Hollow sprue gating (see FOUNDRY, January, 1961).
2. Ceramic shell investment molds.
3. Double degassing of aluminum melts.
4. Vacuum-assist pouring of molds.
5. Elimination of metal turbulence in molds when they are being poured.

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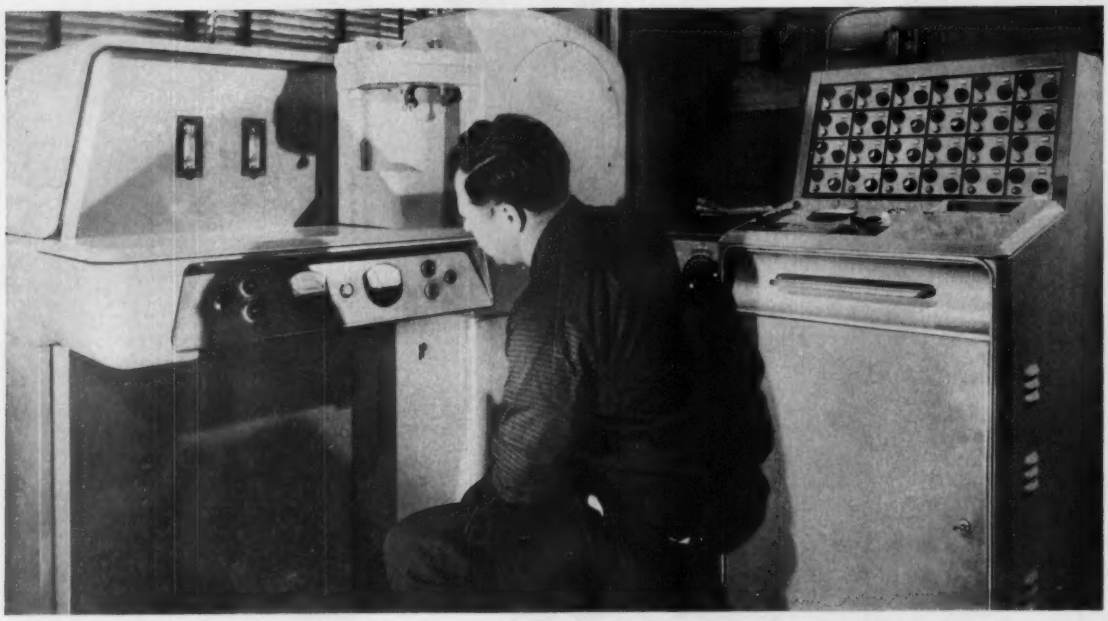


Fig. 1—Operator checks meter readings on an automatic x-ray spectrograph prior to running an analysis. Console at right allows programming of 24 elements for analysis

Automatic X-ray Spectrograph

Speeds Analyzing of Metals

By VERN W. PALEN

Philips Electronic Instruments
Mount Vernon, N. Y.

● HEAT SAMPLES are analyzed in minutes with a spectrograph at the nonferrous foundry of Westinghouse Electric Corp.'s Linhart Works, East Pittsburgh, Pa.

Developed by Philips Electronic Instruments, Mount Vernon, N. Y., the new x-ray instrument provides a complete analysis on furnace melts before they are cast. Previously, it took two to three days to obtain an analysis—long after castings were poured.

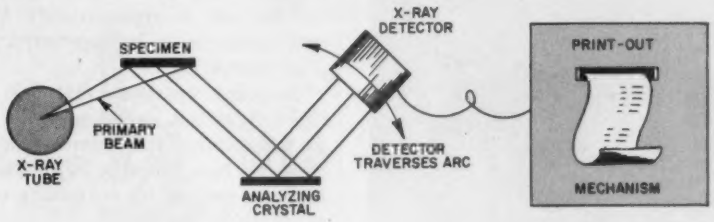
The instrument, called a Norelco Autrometer (Fig. 1), is a sequential x-ray spectrograph which automatically selects the proper crystals and detectors to analyze up to 24 elements in a sample (Fig. 2). The instrument compares number of x-ray counts on the unknown sample with the number of x-ray counts on a standard sample and prints out the ratio on tape (Fig. 3). When the ratio is applied to a calibration curve as shown in Fig. 4, the element percentages can be read directly.

Melting facilities at Linhart consist of eight, 100-kw, low-frequency induction furnaces having an estimated holding capacity of 4500 lb per unit. Metals are introduced into the furnaces as packaged charges made up of materials of known composition. Charging frequently is carried on during off-hour periods so that metal will be molten and at proper temperatures for the first day shift. Samples are taken from each furnace at the beginning of the shift and the analysis is made on the spectrograph.

Check on Variations—When the composition of a furnace varies from the alloy specification, necessary additions are made. Subsequent analysis checks are made until the molten bath conforms to specifications. The spectrograph also is used to analyze raw materials before they are incorporated into

Fig. 2—Diagram shows console setup for elements determined in daily routine operations

Sn 1	Cd 2	Ag 3	Zr 4	As 5	Bi 6
Pb 7	Zn 8	W 9	Cu 10	Ni 11	Co 12
Fe 13	Mn 14	Cr 15	S 16	V 17	Ti 18
P 19	Si 20	Sb 21	Sn 22	Mg 23	Al 24



How the X-ray Spectrograph Operates

An automatic x-ray spectrograph, such as the Autrometer, is useful for fast quantitative analysis. It compares secondary x-rays given off by specified elements in unknown and known samples; then it computes radiation intensity ratios. These ratios are referred to a calibration curve to convert them to percentages.

The instrument consists of a high-voltage source, an x-ray exciter tube, analyzing crystals, a carrier turret, radiation detectors, electronic programming equipment, and a tape printer.

The unknown and standard samples are placed in the carrier turret so that x-rays from the exciter tube cause the characteristic secondary radiation to be given off by each element in the specimens. For each element there is an orientation of the analyzing crystal which allows only its radiation to be measured by the detector.

To operate the spectrograph, the operator indicates on the console the elements to be tested, loads the specimens, and turns on the unit. The instrument selects the correct analyzing crystal and detector and sequences to proper crystal orientation for the first element. X-rays from this element are measured, using the standard sample first; then the turret rotates and radiation from this element in the unknown sample is measured. The ratio is computed and printed on a tape. This procedure is repeated automatically for other specified elements.

Here are some advantages and disadvantages of the automatic x-ray spectrograph

Advantages

1. Speed. Complete analyses usually take less than 15 minutes.
2. Accuracy. Routine x-ray analyses generally are more accurate than routine wet analyses.
3. Nondestructive. Standards, once prepared, can be used repeatedly.
4. Inexpensive. X-ray analysis has proved to be less expensive per analysis than wet analysis.
5. Simple operation. Operator of the unit need not have highly specialized, technical training.

Disadvantages

1. Range. Although the x-ray spectrograph can be used for elements between magnesium and californium on the periodic table, it cannot test for elements below magnesium such as carbon and boron.
2. Accuracy. Although the instrument will indicate presence of trace elements, its accuracy for measuring exact percentages of such elements is limited.
3. Expense of standards. Because very accurate wet chemistry analysis is required for setting up standards, they have a high first cost.

the prepackaged charges.

Metals processed at Linhart consist of virgin metals, alloy ingot, and scrap from other manufacturing operations within the corporation. For example, sheet brass from punching operations is baled at the plant, chemically analyzed, and incorporated in the charge for induction melting.

The foundry produces lead-base alloys for babbitts and solders, aluminum-base alloys for pressure-tight and corrosion-resistant applications, copper-base alloys for electrical and mechanical uses, and tin-base alloys for wear-resistant and high-strength assemblies. Many of the alloys must meet critical specifications and some components are of sufficient value to be termed semiprecious.

Metal samples from the furnaces are taken in small ladles. Since the electric current causes continuous agitation in the furnace, the sample is representative, materials are homogeneous, and elements are uniformly dispersed. Raw material sampling techniques vary to suit the type of material. On rolled sheet, the sample is cut from the lot. Turnings, millings, and bor-

Fig. 3—Portion of tape is for a manganese-bronze alloy. Data are referred to standard curves

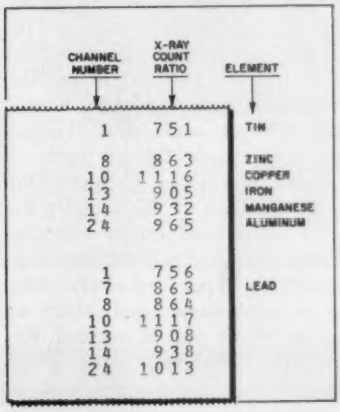


Fig. 4—Typical standard curve. This one is calibrated for a manganese-bronze alloy

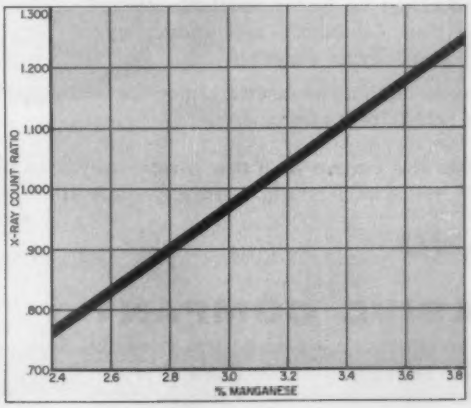
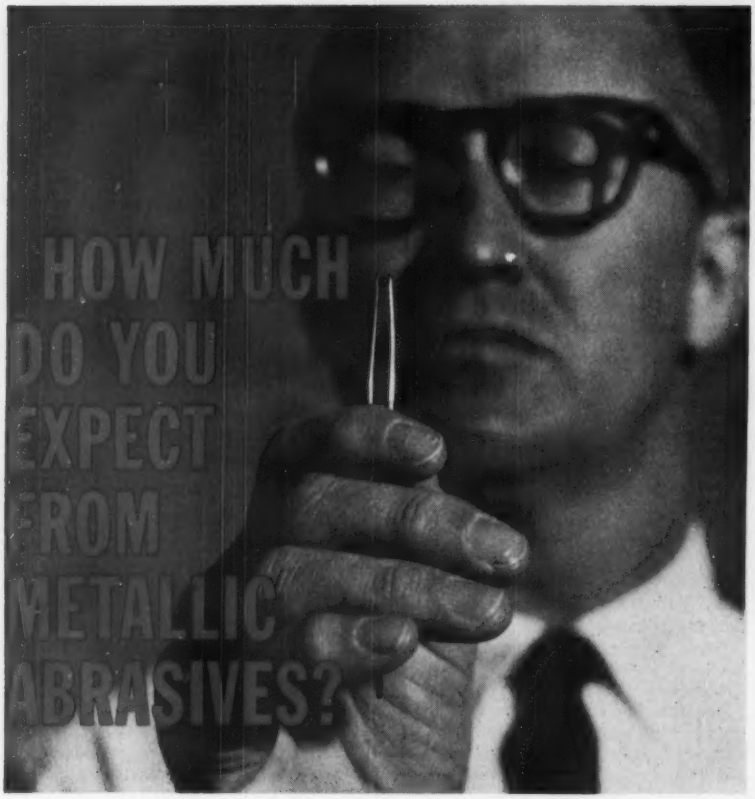


Fig. 5—Sample for analysis is poured into plaster ring. Finished samples also are shown



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ings are selected carefully so that the sample is representative and will continue to be representative after processing.

In many instances, materials of this nature are melted and cast to fit the spectrograph sample holder. This has been found to be the most accurate method for evaluating raw materials of this type.

About 20 to 30 samples are analyzed with the spectrograph daily. Of these, two or three may repeat the same alloy composition. A complete analysis of the furnace metal is run on the eight low-frequency units first thing each morning. During the day, element content is analyzed on the high-frequency furnaces and on the tilting crucible furnaces which process aluminum.

Pouring Samples—Samples are poured into plaster rings (Fig. 5) which are seated on a wrought copper plate so the sample is chilled when it strikes the metal. The chilled surface is the one exposed to the x-ray beam in the spectrograph after it is turned on a lathe to provide a smooth, uniform face. Outside diameter is turned to $1\frac{3}{8}$ in. and height is held to approximately $\frac{3}{4}$ in.

The flat sample surface next is polished by hand, using 100-grit paper. Hand polishing with strokes executed in one direction, not back and forth, has been found to be more satisfactory than belt polishing.

Spectrograph Is Accurate

Experience shows that the spectrograph gives more accurate analysis than was obtained by wet chemistry in the ranges covered by these alloys. For instance, standard manganese brass is analyzed for the following elements down to the minimum values indicated: Tin, 0.01 per cent; lead, 0.01 per cent; manganese, 0.2 per cent; nickel, 0.3 per cent; iron, 1.0 per cent; aluminum, 0.3 per cent; zinc, 0.1 per cent; and copper, 0.1 per cent.

High-Conductivity Copper—One of the problems at this foundry involves high-conductivity copper. Normal specifications for cast copper call for 70 per cent conductivity but in some cases conductivity as high as 90 per cent is required. Recently, in producing such metal there were variations which made

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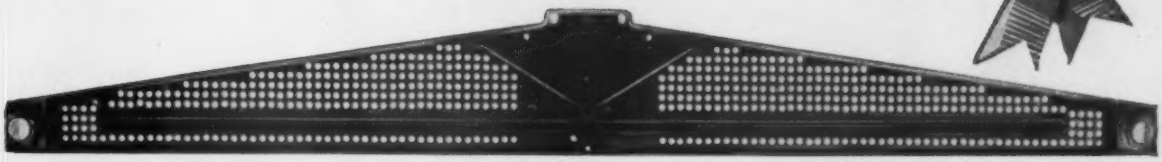
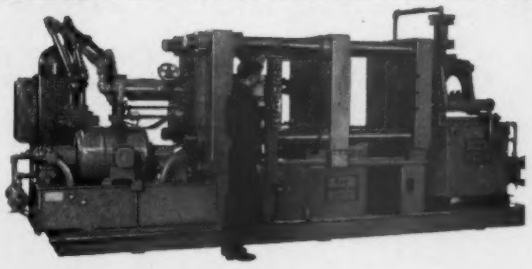


A & A's $1,000-AWARD CASTING—THIS 6-LB. 32-INCH VACUUM CHAMBER FOR AMPEX DIGITAL TAPE HANDLER. CAST AT A SAVING OF 95% OVER PREVIOUS PRODUCTION METHOD.

CONGRATULATIONS TO A & A on their achievement of manufacturing this exceptional wave guide die casting. The casting, having an unprecedented 515 cored holes, was made to the most exacting requirements and tolerances. Two slots running almost the entire 32 inches of casting length are only .007 inches wide, and a flatness within .002 inches end to end is achieved as specified. A perfect cast finish is also a must, as the part is hard chrome plated for wear resistance.



Hydraulically operated plunger gooseneck model BH-600, with strain gage proven die locking pressure of 600 tons, produced the grand prize winner for A & A.

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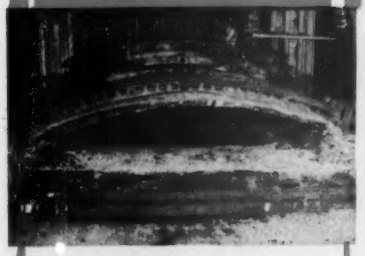
"Toughen up" air furnace bottoms with IRONTON AL-70 BRICK



MELTED 12,000 TONS WITHOUT A SHUT-DOWN

A large production malleable foundry's report shows that **Ironton AL-70** brick lasted 826 hours in an air furnace bottom where metal is tapped at 2830°F. With pulverized coal as fuel, 70% alumina brick stands the gaff better than any refractory used previously.

On a basis of cost per ton of metal produced, **Ironton AL-70** brick are most economical. Longer service and superior resistance to slag and metal attack help to reduce over-all costs of furnace operation. Check this opportunity for savings.

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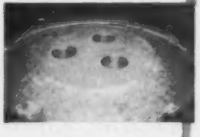

in electric furnace roofs to **Ironton AL-70** brick. In this application, high alumina brick really cuts costs. Ask for details.

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it impossible to meet the 90 per cent requirement.

Samples were analyzed on the spectrograph, and it was discovered that iron was being picked up in processing. The source of the contamination was found to be the iron skimmers which hold back the charcoal on the surface of the molten bath.

It was found that some iron was being dissolved and going into solid solution. Very little iron is required to lower the conductivity from the higher levels. In this instance, the spectrograph quickly discovered the cause and made it possible to eliminate the trouble.

Analyzes Gates and Risers

In another instance, the spectrograph was employed to analyze gates and risers where the copper met conductivity specifications according to electrical surface tests. It was found, however, that a shot blast operation caused shot to become entrapped in the copper. In the subsequent melting process, the iron unknowingly was dissolved into the metal. Thus, the chemistry of the copper met specifications originally but the shot blasting caused iron contamination.

Alloy Range Wide—Since the foundry deals with a wide variety of alloys, suitable standard samples must be maintained for many different analyses. Approximately 45 different alloys are processed at this plant which also includes a copper mill operation, and 20 or more alloys can be active on any given day.

A broad range of this type requires an extensive set of standard samples. They were carefully prepared in co-operation with the Westinghouse materials engineering laboratories.

The standards were cast from experimental heats by a defined method in order to approximate foundry procedure. Then they were checked on both sides for homogeneity and certified by wet chemical methods as to element content. Standard samples are maintained for the most active alloys including copper, manganese-bronzes, tin-bronzes, aluminum bronzes, and the tin-base and lead-base materials. In all, approximately 45 standard samples are employed in the x-ray analytical program.

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MAN TO MAN....

By RALPH L. LEE, *President*
Lee Hobby Foundry, Birmingham, Mich.

Making a New Year Resolution

"Perhaps we'd have better luck if we resolved to do more of the good and profitable things we have been doing during the last year"

● ON THE BASIS of my own experiences, I imagine that even at this early date, a sizable number of our New Year resolutions have begun to sag a bit—and the more drastic one was, the saggier it probably is.

It wouldn't be surprising to find that those pertaining to personal habits such as eating, drinking, smoking, gambling, spending, church attendance, and cussing already have begun to show signs of wear and tear. Those which pertain to the foundry probably are following in the wake.

Still, in spite of low batting averages, some good is bound to come from resolving to quit what we know darned well isn't good for us even as we go right ahead doing it or putting off what we know would be good for us. Intent is important, I guess.

Stopping or Starting—Although I have no statistics except those applying to myself, I imagine that one reason for the high mortality rate of New Year resolutions is that they invariably have to do with stopping or starting something. The thought occurred to me that perhaps we'd have better luck if we resolved to do more of the good and profitable things we already have been doing during the last year. There certainly must be some, even in the Lee Hobby Foundry, or we hardly could have pulled through in one piece, either personally or foundrywise.

Next year, I'm going to take a crack at this resolution thing. In fact, maybe it isn't too late even this season. It certainly would be a lot more fun riddling out the good practices and expanding them —in other words, crowding out the bad with expanded good.

There's a funny thing about the time-proved practices that have been carrying the burden for foundries that manage to come through thick and thin: They're more than likely to be taken for granted, like the long-suffering wife or the old homestead. It's easy to forget the trouble we used to have before they were put into effect and the heck of a time we had putting them into practice.

Carelessness creates problems

Riding the Tide—With so many current problems stacked up yelling to be solved, it's human nature, I suppose, to forget with relief those that are not yelling and to take for granted the routines and practices that are struggling along on their own.

I guess I'm still a boy at heart, for in any foundry I visit I can't resist the excitement of the spark display at the cupola or furnace at tapping time. And there's a spot where current practices are most likely to be taken for granted and left to shift for themselves, except when Hell breaks loose.

Sometimes, for example, one of these disastrous events turns out to be due to a slow accumulation of cheating on drying time for ladles, linings, cupola patchings, sand bottoms, or spouts, one at a time or all together. Not a mystery in the lot. The good old time-proved practices don't stay good if taken for granted.

Charging seems to be another of those grand old routines that gets thoroughly grooved. Old Joe the melter goes through the motions of his job automatically and alone, just as though he had smallpox so far as the boss is concerned—that is, until the trouble starts. Sand-encrusted sprues and gates, wet scrap and pig, a little lead, copper, aluminum, and whatnot sneak into the charge when his back is turned. Gradually neglected scales, wandering bed heights—these and a flock of other careless procedures gnaw

Ajax Magnethermic supplies all types of Induction Melting Furnaces including: core, coreless, lift and automatic pouring. Vacuum melting and degassing applications are among their many uses. 60 cycle, motor generator, mercury arc converters, R. F. generators and the new 180 cycle Multiductor, all products of AM, are available as the power source.

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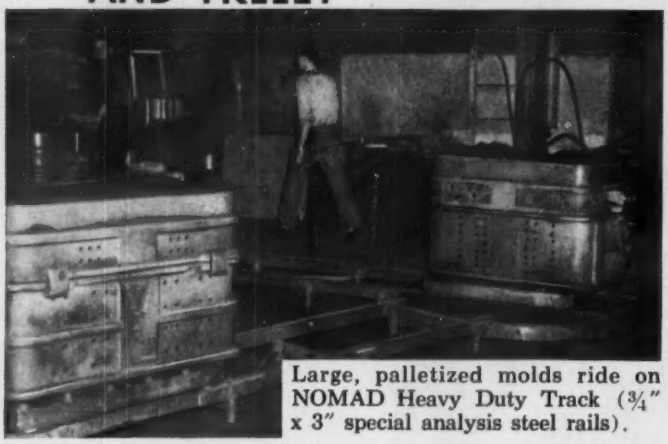
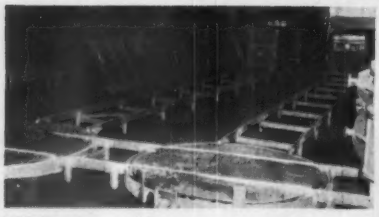
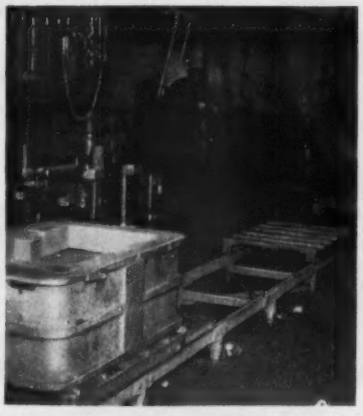


Large, palletized molds ride on NOMAD Heavy Duty Track (¾" x 3" special analysis steel rails).

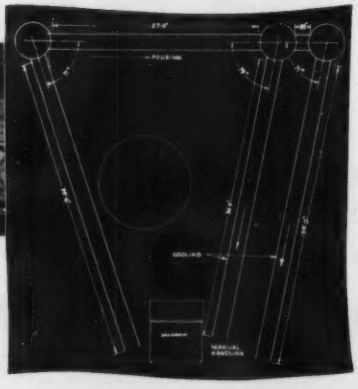
Newly-installed at International Harvester's Milwaukee Works, this NOMAD Conveyor System gives great flexibility—features easy handling of molds of odd shapes and sizes, maintains a high production rate, and reduces manpower, too!



While turntables can be set at any degree, usually 90°, a key point of interest in this installation is the use of specially-indexed turntables routing molds at angles of 71° and 79° respectively.



Note the fabricated pallets which accommodate many mold sizes.



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away at our time-proved practices.

Sand, even under the best conditions, doesn't have much glamor. It's fundamentally cantankerous. I think we all will agree that between spells and epidemics of scrap, we're likely to let sleeping dogs lie so far as sand practices are concerned. And with all the mystery of sand and need for research on it, not doing what we already know how to do is responsible for a good deal of our sand problems.

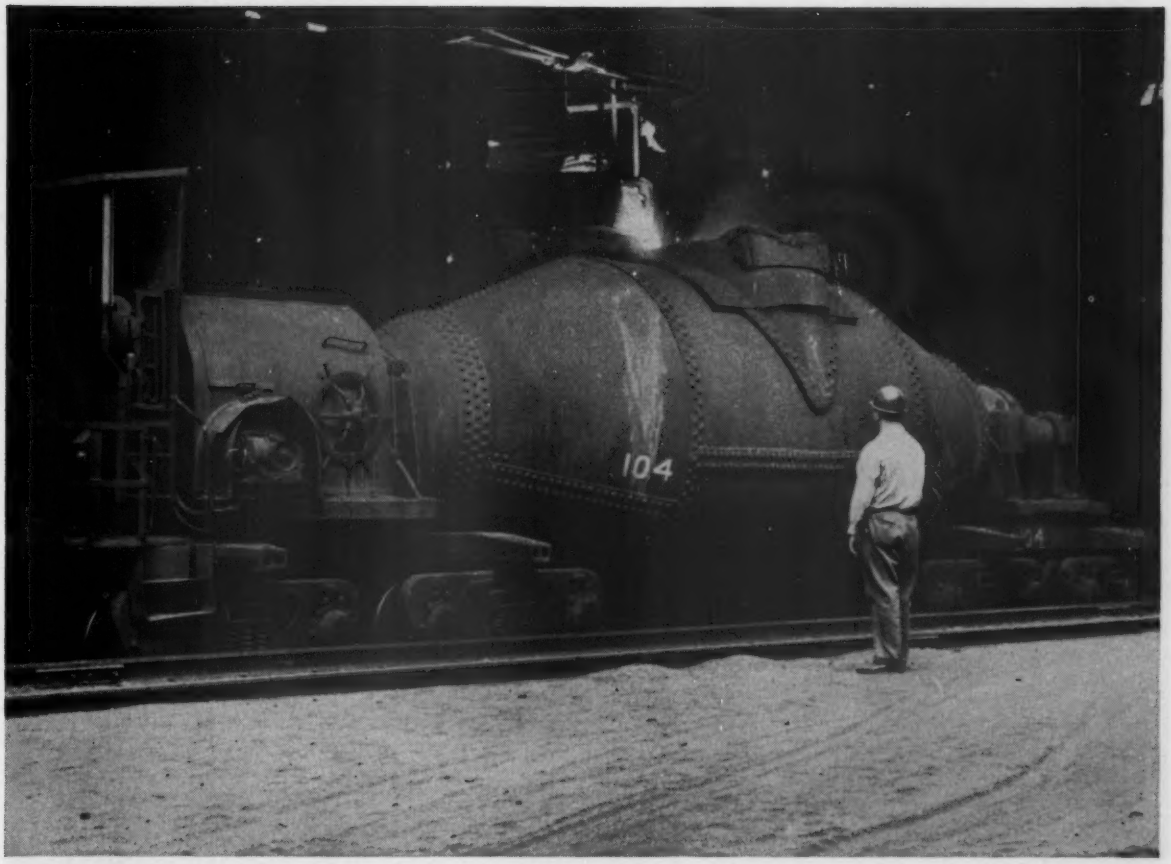
Flasks, flask pins, jackets, boards, patterns, equipment, maintenance operations, mold hardness, gating, risering, and pouring—all are chosen during years of experience and combined with carefully established routines and practices. But with human nature as it is, even the best of things tarnishes a bit with neglect.

Use What We Have—I guess that what I'm trying to say is this: Although there's a whale of a lot we don't know about this challenging foundry craft and a lot of things we wish we had, there also are a lot of things we do know as a result of our experience over the years. And we've gone as far as we have with the tools we already have. The question is whether we are taking full advantage of what we already know and making the best use of what we have.

As president of the Lee Hobby Foundry, I hereby resolve to take an inventory of the tried, proved, and reliable foundry practices now in use in our establishment. I realize that some of them might come in that vague area which divides the good from the fair, but I'm going to concentrate for the time being on the good ones.

We'll be open-minded, of course, about innovations, technical breakthroughs, and other developments within the range of our budget. But it might well be that if we did all of what we already know how to do and did it all the time, the cumulative effect would net us greater gains than the introduction of some wonderworking innovation. And the comforting thing about it is that we can start right where we are, with what we have, and right away.

Oh, by the way—good people, like good practices, also wither or die on the vine when taken for granted.



How mixer-type hot metal cars roll cool at J & L Aliquippa

Transporting *all* the iron produced at Jones & Laughlin's Aliquippa Works is the big job done by fourteen mixer-type hot metal cars like the one shown above. To make sure wheel bearings run cool and keep running even under heaviest loads and impacts, car builder M. H. Treadwell Co. Inc., specified Timken® tapered roller bearings for all the car journals. Because they roll the load, Timken bearings practically eliminate friction. Cars start and roll easier, save power. Because of their taper, Timken bearings take any combination of radial and thrust loads. And full-line contact between rollers and races gives Timken bearings extra load-carrying capacity. Bearings run longer, smoother. Axles run true, minimizing wheel and rail wear. Maintenance is reduced to a minimum.

CALL ON US for expert on-the-spot engineering service on your bearing applications. Our graduate engineer salesmen will gladly work with you right at the design stage. And from the thousands of sizes and wide range of types of Timken bearings they will help you select the one bearing and mounting design that will do the most economical job for you.

Industry rolls on

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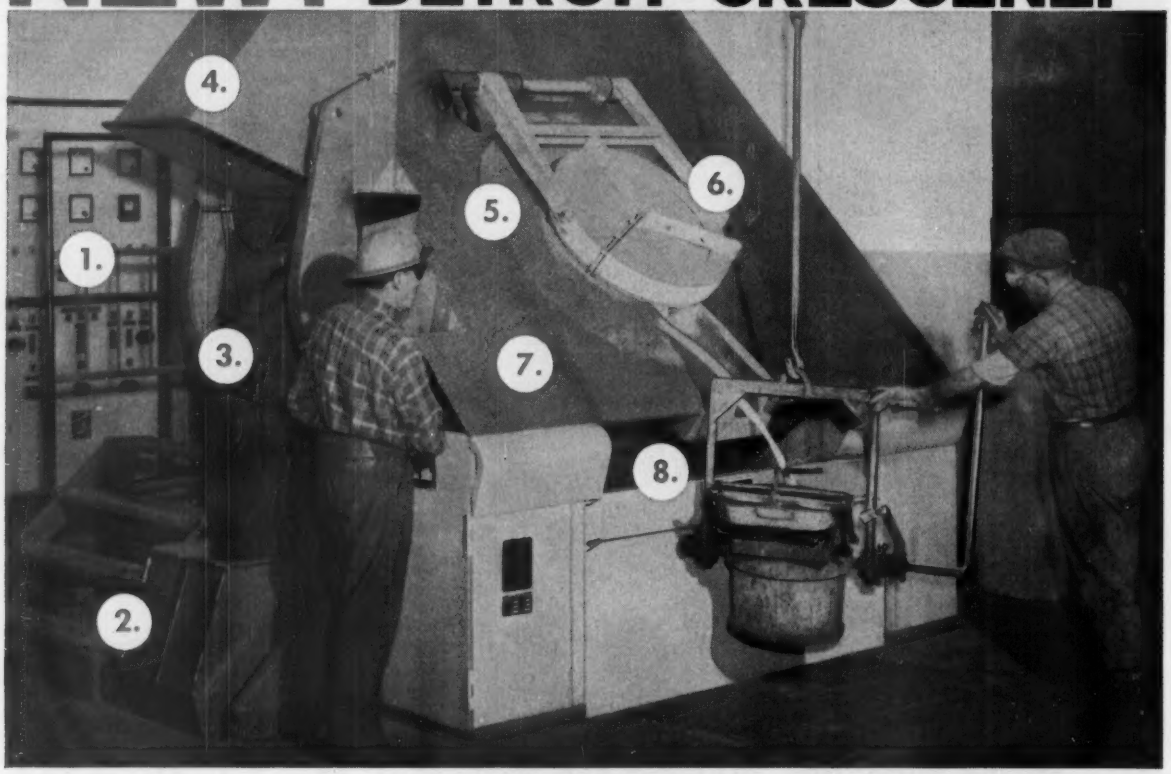
tapered roller bearings

The Timken Roller Bearing Company, Canton 6, Ohio. Cable: "TIMROSCO". Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits. Canadian Division: Canadian Timken, St. Thomas, Ontario.

NEW! DETROIT-CRESCENZI



All the advantages of 60 cycle induction melting plus 8 MAJOR FEATURES:

The new Detroit-Crescenzi offers exceptionally clean melts, high power efficiency, exact alloy composition, even heat distribution and low-cost maintenance for iron and steel melting. It introduces many mechanical and electrical innovations new to induction melting. For example:

1 **More safety devices** and controls to keep closer watch on operating efficiency.

2 **Hydraulic skip charger** that loads at floor level, lifts and . . .

3 . . . **dumps** the charge into the crucible.

4 **Skip hood** to guide the charge into the crucible and confine the metal splash.

5 **Sectionalized coil and yokes.** Should a refractory failure lead to coil damage, only a portion of the coil has to be replaced.

6 **Hinged cover** that keeps heat in during melting and opens hydraulically for charging or inspection.

7 **Hydraulic lift** to smoothly tilt and quickly return the coil-crucible assembly to the melting position.

8 **All-steel construction** that permits removal of coil-crucible assembly without disturbing structural members or lifting mechanism.

Get more facts about the "all new" Detroit-Crescenzi CSA Coreless Induction Furnace. Write for bulletin 6113.

DETROIT ELECTRIC FURNACE

Division of Kuhlman Electric Co. • 26th Street, Bay City, Michigan

Circle 616 on Page 39

LITERATURE for foundrymen

For More Information, Use Reader Service Card—Page 39

Electrodes

Brochure EW-216 lists numerous types of electrodes available. It explains AWS classification numbers, mechanical properties terms, and color codes. Brochure also lists electrode approvals, specifications, and classifications.—**Hobart Bros Co.**, Box EW-216, Troy, Ohio.

For More Details Circle No. 406—Page 39

Air Grinders

Illustrated folder JE-2558 gives technical details on company's line of air grinders and describes new safety valves on the 6 and 8-in. models. Grinders are available with butterfly, lever, or grip throttles.—**Thor Power Tool Co.**, 175 N. State St., Aurora, Ill.

For More Details Circle No. 407—Page 39

Mounter Drives

Bulletin 7100 explains design and construction of firm's shaft and flange mounted drives. It also includes information on motor mounts, bushings, sheave and belt selection, NEMA motor dimensions, and typical mounted drive installations.—**Falk Corp.**, Box 492, Milwaukee 1, Wis.

For More Details Circle No. 408—Page 39

Heat Treating Furnaces

Bulletin GED-4306 discusses fluidized bed heat treating equipment for annealing, normalizing, aging, hardening, quenching, and isothermal transforming. Charts show heating and quenching rates for steel and discuss time savings with other metals.—**General Electric Co.**, Schenectady 5, N. Y.

For More Details Circle No. 409—Page 39

Bucket Elevators

Booklet 174 contains engineering data on various types of bucket elevators and recommends the grade of belting suited for elevating materials of different weights, abrasiveness, temperatures, and other characteristics. The 22-page booklet also contains sections on troubleshooting and belt splicing.—**Hewitt-Robins Inc.**, 666 Glenbrook Rd., Stamford, Conn.

For More Details Circle No. 410—Page 39

Investment Casting

Illustrated 20-page report discusses characteristics, metallurgy, markets, and future trends of the investment casting industry. The report covers developments in investment casting alloys, vacuum melting, improved properties of investment cast superalloys, and properties and heat treatment of 17-4PH and AM-355 stainless steel alloys.—**WaiMet Alloys Co.**, division of Howe Sound Co., 5320 Oakman Blvd., Dearborn, Mich.

For More Details Circle No. 411—Page 39

Safety Glasses

Booklet points out the advantages of company's safety glasses and illustrates the colors and styles available.—**American Optical Co.**, Safety Products Div., Southbridge, Mass.

For More Details Circle No. 412—Page 39

Firebrick

Bulletin 552 covers Medal and Medal P-4 arch and wall shapes and includes technical data on pyrometric cone equivalents, hot load deformation, permanent linear change, panel spalling, and porosity.—**J. H. France Refractories Co.**, 10360 France Rd., Snow Shoe, Pa.

For More Details Circle No. 413—Page 39

Hose Selection

Hose style selection is charted in bulletin 627, in which charts indicate tubestock suitability for carrying various liquids and gases. The bulletin lists 112 separate liquids and gases.—**Aeroquip Corp.**, Jackson, Mich.

For More Details Circle No. 414—Page 39

V-Belts

Bulletin M-201 explains design features and performance advantages of firm's V-belts. The 8-page bulletin also includes special designs for heavy and light duty, short and long center applications, specifications for all belt styles, and ordering information.—**Raybestos-Manhattan Inc., Manhattan Rubber Div.**, Passaic, N. J.

For More Details Circle No. 415—Page 39

Shell Mold Bonding Resin

Brochure "For the Foundry Industry" presents the latest data on SP-7412 thermosetting phenolic resin. Illustrations show method used to eliminate resin drift into mold and finning.—**Schenectady Varnish Co.**, Schenectady 1, N. Y.

For More Details Circle No. 416—Page 39

Catalytic Purifier

Booklet features 11 problem-solution case histories of typical exhaust purifier installations on industrial vehicles.—**Automotive Div., Oxy-Catalyst Inc., Div.**, 511 Old Lancaster Rd., Berwyn, Pa.

For More Details Circle No. 417—Page 39

Testing Apparatus

Leaflet describes firm's testing apparatus and lists data on models available, specifications, and prices—**Adolph I. Buehler Inc.**, 2120 Greenwood St., Evanston, Ill.

For More Details Circle No. 418—Page 39

Electrical Connectors

Bulletin B81 includes illustrations, specifications, and suggested applications for standard and custom-built electrical connectors. Brochure also features a general description of lighting products, information on push-button switches, and stationary and portable cable vulcanizers.—**Joy Mfg. Co., Electrical Products Div.**, 1201 Macklind Ave., St. Louis 10, Mo.

For More Details Circle No. 419—Page 39

Technical Films

Catalog contains a list of free technical films for use by business, industry, and commercial and engineering colleges. The list includes topics on the pure sciences as well as those which affect practical considerations of production and distribution.—**Modern Talking Picture Service**, Three E. 54th St., New York 22, N. Y.

For More Details Circle No. 420—Page 39

Aluminum Alloy

Brochure 103 R 5 describes Tenzaloy, an aluminum casting alloy which ages at room temperature. The 8-page brochure lists specifications and nominal composition and gives details of casting meth-

Did You Miss These?

Here is a list of popular literature items offered in recent months:

ALUMINUM FLUXES—Foundry Services Inc., Cleveland 35, Ohio. Circle 402, Page 39.

HIGH ALLOY CASTINGS ("Technical Publications List")—Alloy Casting Institute, Garden City, N. Y. Circle 403, Page 39.

CO_2 CORES and MOLDS (Brochure ADPC 27A)—Pure Carbonic Co., division of Air Reduction Co., New York 17, N. Y. Circle 404, Page 39.

OLIVINE SAND ("Olivine Sand and Flour in the Foundry")—Balsam Gap Co., Philadelphia 2, Pa. Circle 405, Page 39.

ods, dimensional stability, corrosion resistance, machinability, and welding, brazing, and plating techniques.—**Federated Metals Div., American Smelting & Refining Co.**, 120 Broadway, New York 5, N. Y.

For More Details Circle No. 421—Page 39

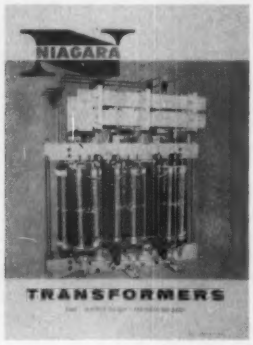
pH Meter

Bulletin 706-F describes Zeromatic pH meters with standby circuits to eliminate warm-up periods between measurements. The meters measure over a 0 to 14 pH range and give millivolt readings to ±1400 mv.—**Beckman Scientific & Process Instruments Div.**, Technical Information Dept., 2500 Fullerton Rd., Fullerton, Calif.

For More Details Circle No. 422—Page 39

Transformers

Bulletin 160 features ventilated dry type transformers in single and three-phase construction. Standard operating conditions and optional features are listed



together with specifications, dimensional drawings, and sound level charts.—**Niagara Transformer Corp.**, P. O. Box 23, Buffalo 25, N. Y.

For More Details Circle No. 423—Page 39

Dry Hearth Furnaces

Bulletin 594 explains the advantages of dry hearth furnaces. It contains specifications and diagrams for type DCT, DCR, and DCB aluminum melting and holding furnaces.—**Hevi-Duty Electric Co.**, division of Basic Products Corp., Milwaukee 1, Wis.

For More Details Circle No. 424—Page 39

Gray Iron Sizes and Shapes

Two booklets are offered on company's Meehanite standard sizes and shapes. Handbook lists types available and provides data on properties; other booklet is an illustrated price list of all sizes and shapes and also contains ordering information.—**Greenlee Foundry Co.**, 4600 W. 14th St., Chicago 50, Ill.

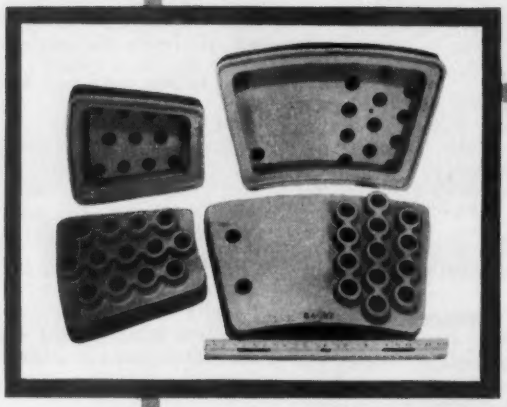
For More Details Circle No. 425—Page 39

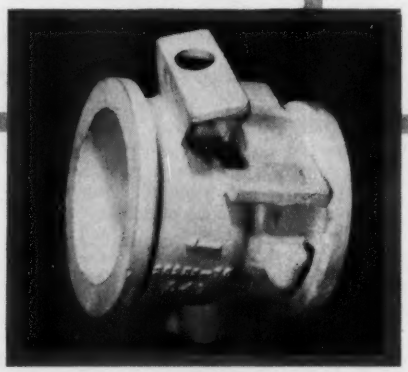
Clamps and Couplings

Industrial catalog No. 803 contains product information on band and hose clamps, couplings, flanges, and V-band joints for all types of applications. The 44-page catalog offers product dimensional

QUALITY CASTINGS *are our business*

We don't make castings—but our customers do. And, these customers—leaders in the foundry industry—have learned to rely on Whitehead for their alloying needs. In all of the castings illustrated, the alloys needed to impart their special properties were all available from Whitehead.





*Producers' names available on request

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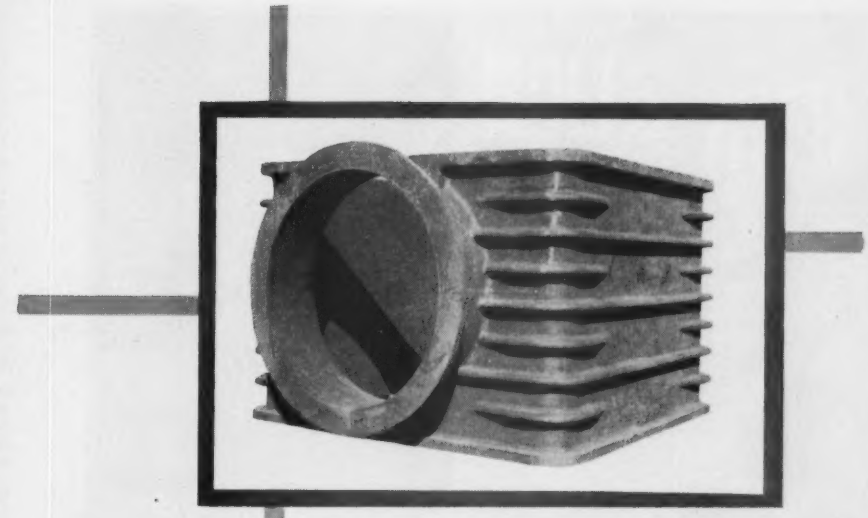

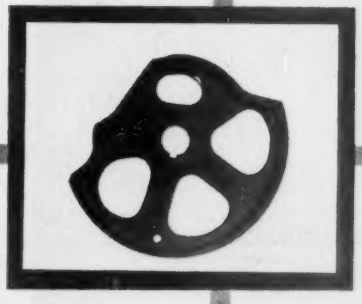

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and operating data and design information. — **Marman Div., Aeroquip Corp.,** 11214 Exposition Blvd., Los Angeles 64, Calif.

For More Details Circle No. 426—Page 39

Motorized Drives

Bulletin MD-1 describes the construction and outstanding features of motorized drives and lists styles available. Folder also includes illustrations and selection tables.—**Howell Electric Motors Co.,** 408-16 N. Roosevelt Ave., Howell, Mich.

For More Details Circle No. 427—Page 39

Grinders and Buffers

Bulletin 112 illustrates and describes buffers and three styles of grinders. The booklet includes specifications for all sizes of buffers and grinders described.—**Grinding & Polishing Corp.,** 2530 Winthrop Ave., Indianapolis 5, Ind.

For More Details Circle No. 428—Page 39

Air Receivers

Catalog describes air receivers for truck-mounted compressors. Diagrams of vertical, horizontal, and portable models and dimensional charts of all models available are included.—**Kargard Co.,** Mariette, Wis.

For More Details Circle No. 429—Page 39

Mounted Point Wheels

Brochure contains specifications on wheels available, wheel shapes, diameters, and lengths; mandrel diameters; and list prices.—**American Emery Wheel Works,** Red Bridge, Providence 1, R. I.

For More Details Circle No. 430—Page 39

Storage Facilities

Catalog contains specifications, diagrams, and prices of benches, bins, cabinets, shelving, stock carts, and accessory

equipment. It also shows the numerous styles that are available of each type of equipment.—**Bay Products Inc.,** 1801 W. Cambria St., Philadelphia 32, Pa.

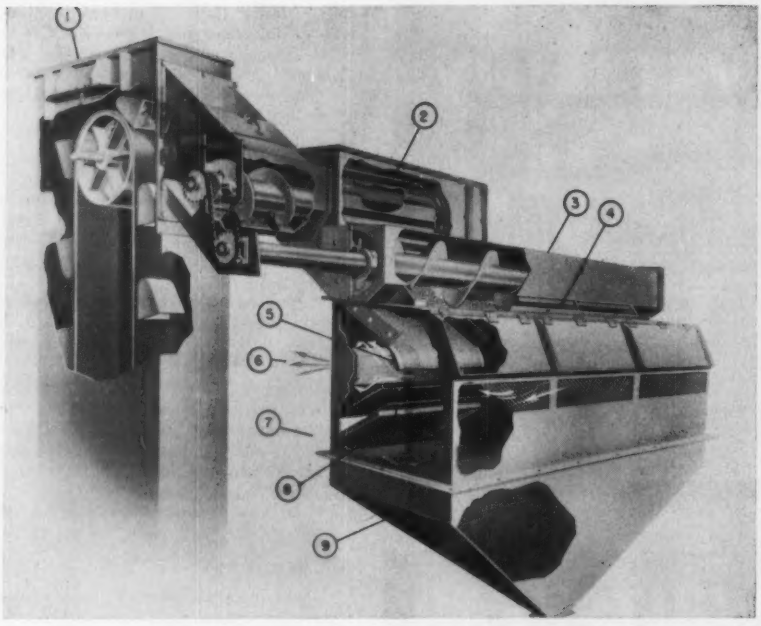
For More Details Circle No. 431—Page 39

Safety Goggles

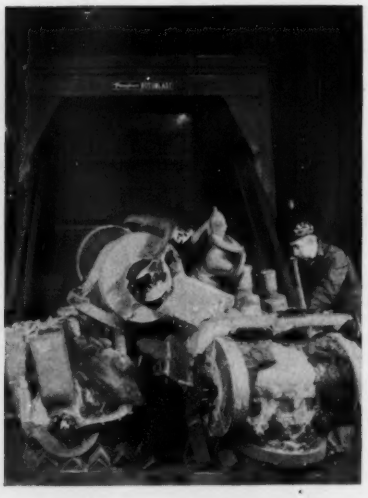
Brochure illustrates various styles of cup-type goggles and lists their advantages. —**Fendall Co.,** 2222 W. Diversey Parkway, Chicago 47, Ill.

For More Details Circle No. 432—Page 39

Circle 617 on Page 39



An abrasive separator of this type performs blast cleaning and core removal simultaneously. Components include the following: 1. Elevator. 2. Scalping drum. 3. Screw conveyor. 4. Orifice plates. 5. Stratification plate. 6. Airflow. 7. Light debris. 8. Fine refuse hopper. 9. Bin



Valve castings which weigh up to 3400 lb are cleaned and the cores removed in the cleaning unit seen in the background

Unit Simultaneously Performs

Cleaning and Core Removal

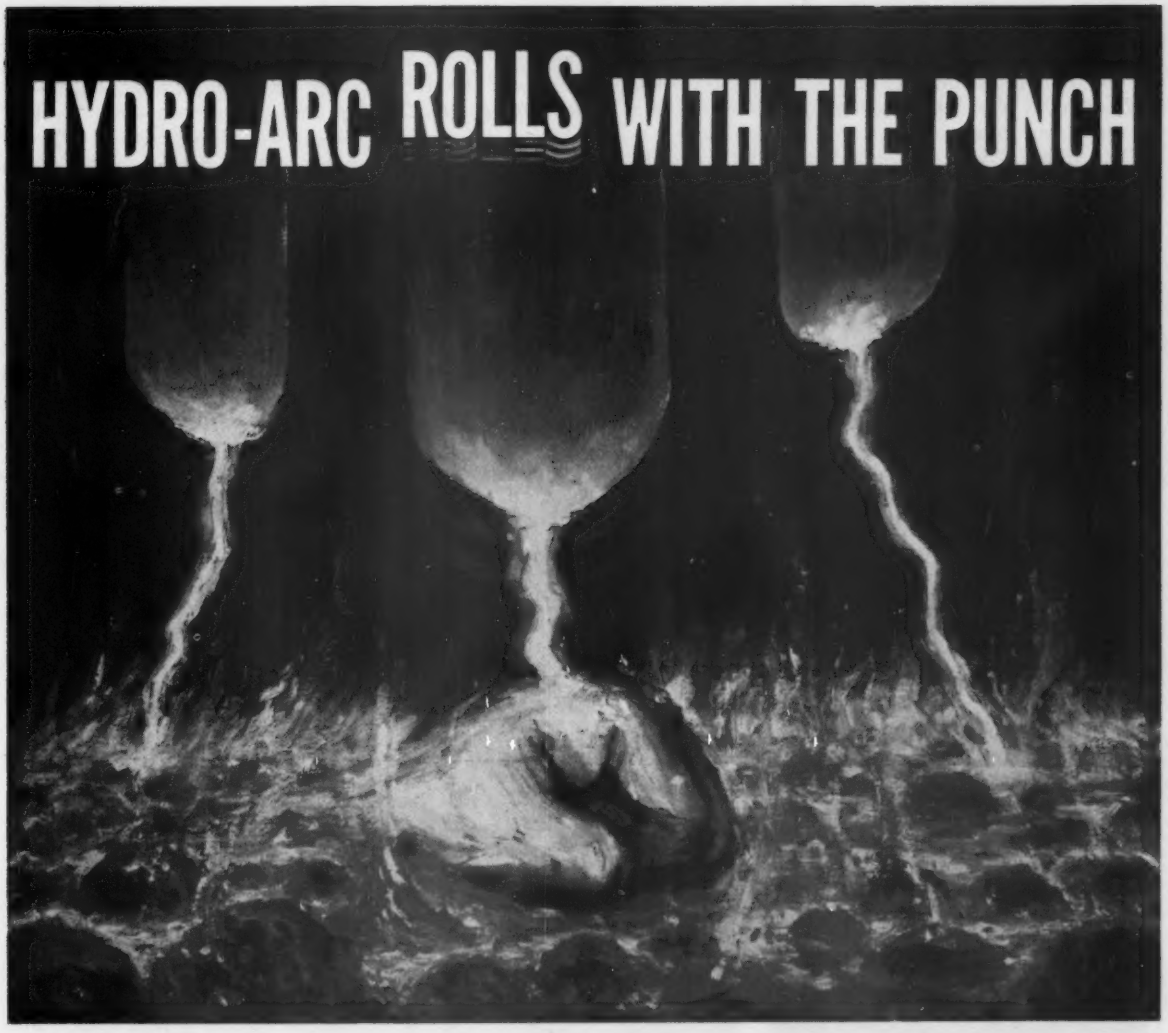
By GEORGE W. POWELL
Chief Engineer
Pangborn Corp., Hagerstown, Md.

● SIMULTANEOUS blast cleaning and core knockout has been accomplished successfully at a Pennsylvania steel foundry for more than three years. A king-sized blast cleaning barrel has proved the feasibility of the combined operation with large pressure castings which include more than the usual number of core rods, gates and risers, and large cores that provide heavy sand loads.

A standard design, 72-cu-ft Pangborn Rotoblast barrel cleans castings and removes more than 1000 lb of core sand from loads in excess of 5000 lb in 8 minutes. Many of the castings weigh more than 3400 lb each. Besides saving floor space and reducing equipment needed, the combined operation enabled this company to cut its labor costs by about 200 manhours per week.

Separation Problem—To make simultaneous cleaning and core removal possible, equipment manufacturers first had to solve a special

The cores have been removed from these two valve castings during an 8-minute cleaning cycle in a 72-cu-ft blast cleaning unit



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WHITING

MANUFACTURERS OF CRANES: TRAMBEAM® HANDLING SYSTEMS; PRESSUREGRIP; TRACKMOBILES; FOUNDRY®, RAILROAD, AND SWENSON CHEMICAL EQUIPMENT

Circle 618 on Page 39

abrasive separation problem: A heavy surge of sand floods the abrasive cleaning and recycling system as the tumble action of the castings and the blast stream team up to knock out cores.

The problem was not only how to increase capacity of the separator, but also how to flatten the hypothetical peak in the curve of sand load vs time—that is, how to spread the sand load over a longer period of time to keep the surge below the rated capacity of the separator.

Airwash Separator Does Job — After a number of designs had been evaluated, one seemed to offer many advantages. This separator, similar to the one used on the 72-cu-ft barrel, utilizes the airwash principle and has a flat, inclined stratification plate. It can be used singly or in multiple, side-by-side sections, eliminating the need to manufacture a number of different sizes. Only one elevator is necessary.

The single belt-bucket elevator passes abrasive to the separator, on the roof of the blast cleaning machine, and a screw conveyor feeds it to a perforated scalping drum. Coarse refuse is removed, and the abrasive-sand mixture sifts through the scalping drum into a second screw conveyor.

The scalping drum is lined on the outside with a series of longitudinal, unperforated louvers which trap and discharge stray wires, nails, or rods small enough to pass through the perforated drum. As a result, nothing larger than the usable abrasive passes the scalping drum. This second conveyor spreads the mixture over an adjustable orifice plate which forms the roof of each 30-in. separator section.

Orifice Plate Does Two Jobs— The orifice plate is adjustable to pass only the desired amount of the mixture, which, of course, cannot exceed the rated capacity of the separator section. It also distributes abrasive evenly across the entire length of the inclined stratification plate.

After the abrasive has cascaded through the orifices onto the stratification plate, the light material—sand, scale, and pulverized abrasive—settles to the bottom of the stream. Where the mixture falls away from the stratification plate, the heaviest material—usable abrasive—is acted on by the airwash first and the lightest particles are acted on last.

Because sand offers less resistance to the airflow, it is blown farther from the line of fall than the usable abrasive. A skimmer plate within the falling stream is adjusted so that all material lighter than a given weight is blown beyond the skimmer edge to be discharged as refuse. Everything heavier than this value falls to the "upwind" side and is collected in the usable storage hopper.

Coarse Material — To remove such refuse as core rods, wires, nails, gates, and risers, the barrel uses a shaker-screen conveyor inside the blast cabinet, beneath the work conveyor. Larger pieces are screened before the abrasive stream enters the elevator. All remaining coarse items—nails, wires, and fins—are removed by the scalping drum, as described previously.

Proper Separator Required — It should be noted that this kind of abrasive separation is not standard equipment. The abrasive cleaning and recycling equipment provided with most blast cleaning barrels is not designed to handle the core removal problem.

High-capacity separators are, however, neither costly nor cumbersome. Properly designed, they can provide high efficiency at modest cost, with easy maintenance and automatic operation. The benefits and savings are illustrated by the Pennsylvania steel foundry installation.

Franklin Institute Offers Metals Research Studies

Franklin Institute Laboratories, Philadelphia, has compiled a portfolio on its published studies in metallurgy, physics of metals, and other areas of metals research which is available without charge to executives who request the study on corporate letterhead.

Direct requests to Dr. Nicol H. Smith, Franklin Institute Laboratories for Research and Development, 20th & Franklin Parkway, Philadelphia 3, Pa.

With the CM Meteor, you have a choice of two precise speeds at your finger tip... regardless of the weight of the load... and regardless of the direction of travel—up or down. Just depress the (up or down) push button part way for slow, steady "creeping" speed... all the way for fast speed. It's as simple as that. And either speed can be held as long as desired. It's one of the reasons so many, many foundries favor the CM Meteor.

CAPACITIES 1/2 TO 5 TONS

- Designed for heavy duty service. Airplane type cooling. Thermal protection for motor.
- Compact, enclosed construction gives full protection under foundry operating conditions.
- Balanced design. Low headroom.
- Only 110 volts at push button control. Safety type hook blocks.
- Precision bearings. Helical gears.
- Long life with minimum maintenance.

METEOR Catalog covers construction ...suspension... operation details. Send for a copy and name of distributor.

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G-E silicones offer a combination of properties that makes them ideally suited for perfect separation of highly-adhesive resin and sand from metal shell-molding patterns:

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For peak efficiency, put G-E Silicone Release Agents to work on your shell core, mold and hot box applications. Frederic B. Stevens, Inc., also offers a complete line of G-E silicone fluids, emulsions and solutions to meet every mold release requirement for foundry operations.

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DETROIT 16, MICH.

BUFFALO CHICAGO DETROIT MILWAUKEE CLEVELAND
WALLINGFORD (CONN.) INDIANAPOLIS SPRINGFIELD (OHIO)

Circle 620 on Page 39

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Get quicker starts with fully automatic single speed torque transmission. No shifting. You accelerate to speeds up to 13 mph in 5.5 seconds. Save on maintenance costs through Yale's sealed hydraulic system that keeps dirt out. Count on greater safety due to strong frame and safety arm design that protects driver. To make your work cycle faster, bucket returns automatically to digging position. You finish hauling jobs quicker with short 45° ground-level tip back bucket and 6 ft. dumping clearance. Plenty of power with 72HP 6 cylinder engine. Capacity 2,500 lbs. A tractor shovel in a class by itself.

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Put this tractor shovel to work immediately with one of Yale's Flexible Leasing and Financing Plans. Your Yale representative has details.

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The SANDMAN Says . . .

By HAROLD E. HENDERSON
H. C. Macaulay Foundry Co.
Berkeley, Calif.

"The Value of Debate"

● WE MAY justly boast of the wonderful progress made in mass communication, including radio, television, and printed material. And we may expect more rather than less of all this. The advantages of these facilities for the spread of information and entertainment are obvious, but in our eagerness to discard some of the older methods, perhaps we've overlooked some of the values lost.

Are we becoming confused or enlightened in this marvelous age of science? Someone has observed, perhaps facetiously, that a filing cabinet is a scientific method of losing things.

That Oldtime Debate—At the moment, I'm thinking of the oldtime debates, held both in and out of doors, in which two or more men hotly presented their individual views before an enthusiastic audience. These became a source of entertainment and education, as well as just plain pleasurable excitement. The listener usually felt that he was an active participant in everything that occurred—in every argument presented. There was a personal impact, an intimate exchange of ideas.

Today we listen to speeches and slanted discussions completely devoid of the debating spirit. This generalization would appear to be particularly true of many of our foundry gatherings. Questions may be asked of a speaker, but they invariably are soft, polite questions, and the answers rarely are satisfactory.

Where a group of foundrymen gather to give open vent to their problems, talking sand in foundry language, rather than resorting to the more technical terms of the laboratory, confusion is greatly reduced and results seem more assured.

Conflict of Opinions—Many of us at times find ourselves lost in a maze of conflicting opinions. Endeavoring to cure a deplorable condition, we discover that we have created something even more undesirable. When sand trouble becomes progressively worse, and radical measures appear to be imperative, the sandman finds himself on the horns of the well known dilemma. He gets advice and orders from all quarters, much of it contradictory.

Experts are called in—not one, but two or three of them—to diagnose and prescribe. They seldom agree on the immediate steps to be taken, and the poor muller man has to sweat it out as best he can.

Test Batches—It would seem to be a good investment for even a small foundry to have a laboratory muller—that is, one that will handle from 1 to 3 cu ft. of sand—so that test batches could be made to determine quickly and economically just what happens when controlled changes are made.

A cubic foot of mulled facing is sufficient for the average casting molded in green sand, and sand for several molds could be mulled for a single heat, with all details carefully recorded and the molds marked to identify the casting results. Such experiments could prove most enlightening.

When all new sand was used, we could be reasonably certain that results would be dependable and reproducible. When we are endeavoring to doctor an entire system, however, we are dealing with so many unmeasurable variables that we are forced to resort to empirical remedies, even those which may appear to be fantastic.

I recently was asked by a noted sand technician, "What does your present system sand consist of?" I couldn't have given him an intelligent answer if my life had depended on it.

It is as if a doctor were to ask his patient, "What have you been eating? How long has this condition of yours been developing?"

There are simple answers of course—usually evasive—but any intelligent doctor will pay only passing attention to them. Experience has taught him that most physical breakdowns are the result of hidden causes and of habits of considerable duration.

Changes in System Sand—In the course of a year—and this is a comparatively short foundry period—most system sands undergo a series of changes that defy explanation. Substitution may have been made for the original base sand; if no known change has occurred in the foundry, perhaps nature has altered the bank or pit.

When periodical additions of a coarser or finer sand are deemed expedient, these can affect system behavior materially, requiring a ratio change in clays, moisture, etc. Although we may have reasonable knowledge and control of the additives (seacoal, woodflour, clays, and pitch) applied to any given muller batch of sand, the cumulative effect of these materials becomes a matter of pure speculation. Our most reliable indicators at

present may be found in the loss on ignition or volatile tests and the AFS clay determination method.

These, however, are quantitative, not qualitative, and do not explain the erratic behavior of a sand which otherwise seems to meet accepted standards.

Charlie Schureman once insisted that extended mulling time would improve the important properties of any synthetic molding sand. He claimed that in testing two sands of identical composition, one mulled for 4 minutes and the other for 20 minutes or longer, there might be no observable difference in the test readings, yet moldability and casting results would be improved visibly by the longer mulling cycle.

Congregate and Explore—Many subjects related to casting defects could provide a most stimulating and fruitful debate for any group of foundrymen sufficiently courageous to congregate and explore their pet theories.

If, as we are told, two (or more) heads are better than one, and even if no immediate solution to a problem was found, the forceful airing of opinions would serve to clear the air and might stimulate a group desire to conduct a series of controlled tests.

Working from different angles and with different materials, these tests would be likely to result in some practical solutions to everyday problems. The foregoing is more than a theory, for it was demonstrated successfully by a representative group of foundrymen in the San Francisco area.

A Case in Point—E. C. Sawyer, of Zanesville, Ohio, again takes issue with me for what he considers my unfair attitude toward naturally bonded sand. It is possible that his complaint is well founded.

I once heard an expert say that when he found a heavy casting shop in serious sand trouble, the best medicine he knew of was Millville gravel, which is (or was) one of the finest naturally bonded sands in the country. If this is true of Millville, it probably is true of that of other areas.

Despite what appears to be my bias toward synthetic practice, my arguments seem to have fallen on deaf ears among my friends who produce brass and aluminum castings. They seem loath to depart from their use of the sand that has served them so long.

They do, however, complain endlessly about the wide variations in properties between shipments of their favorite sand, transportation costs, and the low durability generally experienced. Even Mr. Sawyer does not hesitate to recommend bentonite additions.

A Possible Solution—Have we been too hasty in condemning everything associated with past practice? It has been argued that if we spend half the attention and half the money on improvement of our green sand practice that we now devote to shell molding, we could obtain equal results at a much lower cost.

It also may be assumed reasonably that excellent and perhaps even more dependable results might be obtained with a premium quality of naturally bonded sand if we were as meticulous in its treatment as we try to be with our so-called synthetic mixes.

Cleaning room costs are a part of the price of your product. Reduction of these costs may well spell the difference between swimming and sinking.

National Metal's **New Controlled "T"®** shot and grit, for instance, represents a new break-through for chilled iron users: A half a ton of **New Controlled "T"®** will do the work of a full ton of ordinary chilled iron abrasives. Sure, you get longer life, but abrasive costs are only a part of cleaning room costs. Savings in maintenance and time add up to a hefty plus factor, too!

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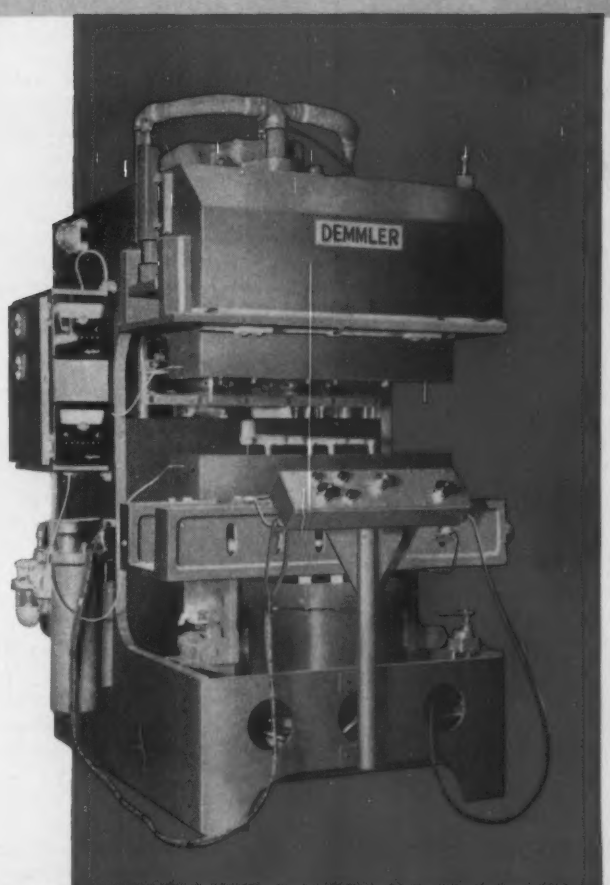
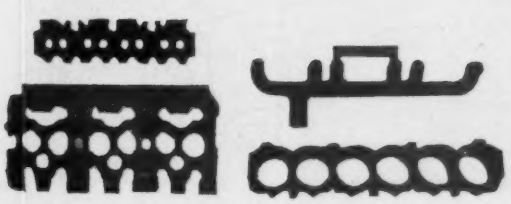
designed to blow furfuran or phenolic resin mixtures into gas-heated, temperature-controlled core boxes

DEMMLER advance-engineering has produced this high-production, low-maintenance edge-blow core blowing machine with fully-automatic cycle. Versatile, it blows cores from pin-type to 48" long. A new ejector feature lifts cores from core box easily without breakage. No rapping or vibration required. Its large capacity blow valve and air-receiver permits core-blowing pressures to 100 psi. Available in three sizes to fill a wide range of applications. Wire or write for additional details and quotation.



Typical cores produced by DEMMLER Edge-Blow machine:



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Circle 624 on Page 39

Photo shows curved, tapering steel mandrel. Cast in high-alloy steel containing 15 per cent chrome and 35 per cent nickel, the part had a pouring weight of more than 8 tons

Exothermic Riser Lining

Gives Dual Benefits

● FOUNDRY use of exothermic compounds to attain higher metal strength and greater casting yield is broadening.

The exothermics, which generate heat upon contact with molten metal and maintain high temperatures in the riser during the feeding process, are adapted for use with both ferrous and nonferrous metals. They are especially valuable when design limitations of the casting restrict normal riser sizes and positioning.

Michigan Standard Alloys Co., Detroit, for example, used an exothermic riser lining in casting the curved, tapering steel mandrel shown here. The casting was unusual because the shape was conducive to directional solidification.

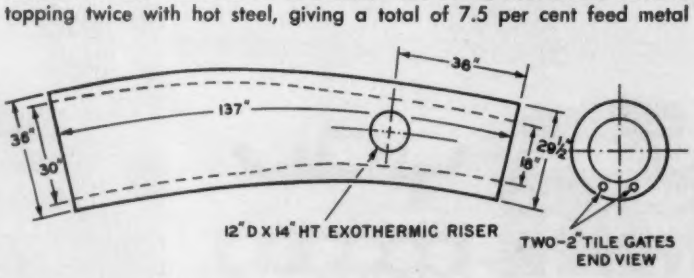
The foundry located one riser, 12 in. in diameter and 14 in. high, in the position indicated in the sketch. This riser was lined with Feedex, a moldable exothermic compound manufactured by Foundry Services Inc., Cleveland.

Use of the compound permitted employment of a smaller riser than required in conventional practice because the riser metal remained fluid for a longer period, increasing the feeding efficiency and eliminating shrinkage porosity. Although the riser contained only 2.5 per cent feed metal, the exothermic action allowed the head to remain open long enough to permit topping twice with hot steel, giving a total of 7.5 per cent feed metal.

Because the exothermic required less metal to flow through the mold, sand erosion was minimized and metal penetration reduced, producing an exceptionally clean, sound casting. Yield was an excellent 91.5 per cent.

Cast from a high-alloy steel containing 15 per cent chrome and 35 per cent nickel, the mandrel conforms to Class 2-x-ray specification. Pouring weight was 16,640 pounds and shipping weight 15,228 pounds. Pouring temperature of the casting was 2650° F.

Exothermic riser was located as shown. Use of the riser sleeve allowed topping twice with hot steel, giving a total of 7.5 per cent feed metal



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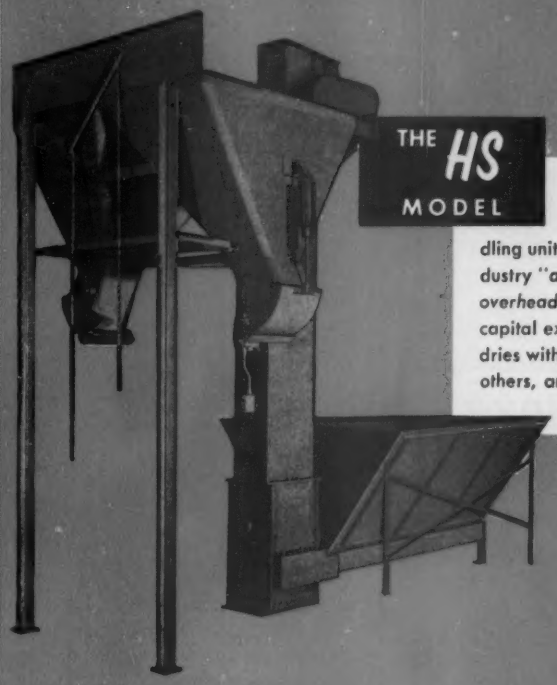
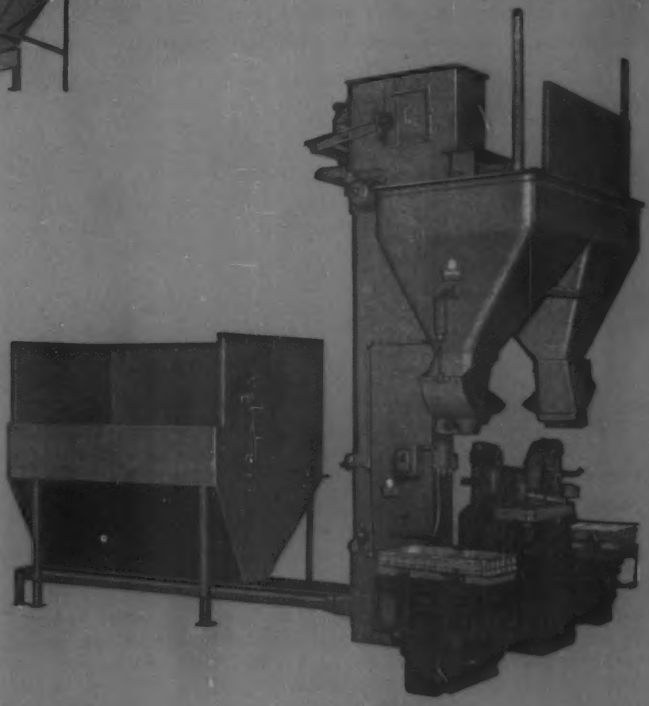
EXPANSION OF MODELS
for EXPANSION OF CAPACITY!



THE HS MODEL

6 TO 7 TONS OF SAND CAPACITY PER HOUR

This low-cost, individual-floor sand handling unit, enthusiastically accepted by the foundry industry *"as the most economical method for furnishing overhead sand to molding stations,"* takes a low capital expenditure to progressively mechanize foundries with HANDY SANDYS. One installation leads to others, and the savings with each one helps pay for the next HANDY SANDY.



THE EHS MODEL

"BIG BROTHER of the HS Model"
UP TO 20 TONS OF SAND CAPACITY PER HOUR

8-inch by 5-inch cast buckets; 10-inch wide rubber-covered elevator belt; cast head and tail pulleys; heavy duty anti-friction bearings throughout; cutting blade type of aerator with separate motor drive.

Newaygo MOVIES are yours for the asking

"PROGRESSIVE MECHANIZATION," a 16mm, 33-minute, movie shows Newaygo equipment in nine foundries. "NEWAYGO PALLET SYSTEMS FOR MOLD HANDLING," another 16mm. 25-minute movie, presents many types of Pallet Line installations in foundries.

"Foundry Business is **BIG** BUSINESS . . ."

Write for BULLETIN 59

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NEWAYGO, MICHIGAN

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"A great labor saver", says Bill Roberts, V. P. of The Markey Bronze Bushing Co., Delta, Ohio

ease the profit squeeze

Other owners report many ways these modern tractor-shovels reduce handling costs:

Power and Capacity — "Before purchasing the H-25, we had competitive demonstrations that proved its production efficiency over other machines" . . . "Good digging power and traction — gives nearly twice the production of our old HA's" . . . "The most efficient loader we've ever used — outperforming larger loaders."

Speed and Mobility — "Power steering and power-shift combination gives us maximum efficiency from both machine and operator" . . . "Quicker on the lift, dump and go — is more compact, gets into smaller places easier and faster."

Operating Ease — "Power steering and no clutch is a must. You get full loads without spinning wheels and the operator lasts longer too" . . . "I like the maneuverability and work capacity."

Reliability — "The low maintenance on the H-25 is way superior to any loader previously used. It's a real producer, easy to service" . . . "We find it stands up under tough, rugged duty with minimum repairs" . . . "Gives maximum production output under ideal or adverse conditions."

Profitable Performance — Reports like these, from owners and operators alike, on the 2500-lb. operating capacity Model H-25 reflect the kind of money-saving performance that is built into all "PAYLOADER" units. Whatever your handling problem may be, there is a proper size "PAYLOADER" to do the job more efficiently . . . 8 sizes and 20 models, up to 12,000-lb. operating capacity, to meet your needs. If you want to lower costs and increase output in your bulk handling, make it a point to talk "PAYLOADER" with a Hough Distributor nearby. Contact him direct or write for more details.

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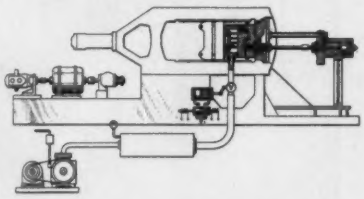
PATENTS of INTEREST

Vacuum Diecasting

Arrangement for vacuum diecasting includes relatively movable die members and a metal chamber with piston or plunger. The chamber is somewhat larger than necessary to hold enough metal to fill the die cavity. The movable die is sealed against a chamber attached to a vacuum source. In operation this die and chamber are closed and sealed against the fixed die which is attached to the metal or feed chamber.



A predetermined amount of metal is poured into the metal chamber, and the piston is moved sufficiently to close off the feed opening. Vacuum is placed in operation, evacuating air from the die cavity and runners and gases from the molten metal. Then the piston is energized to force the metal into the die cavity. *Patent No. 2,958,104 granted to Charles W. Ohse.*

Resin-Coated Sand

Shell molding sand, its manufacture, and use is described. Employs a one-step, water-borne phenolic resin plus hexamethylenetetramine for coating the sand by the hot process. Suitable resin is formed of 42.9 per cent phenol (90 per cent), 0.81 per cent calcium hydroxide, 1.63 per cent water, 52.91 per cent formaldehyde (37 per cent), and 2.06 per cent ethanol.

In making the coated sand 8½ lb of the resin is added to 200 lb of sand with 0.85 lb hexamethylenetetramine in a muller. Mixture is mixed for about 6 minutes during which time hot air at 300 to 350° F is blown through the muller. Mulling is continued until the mixture breaks down into free-flowing dis-

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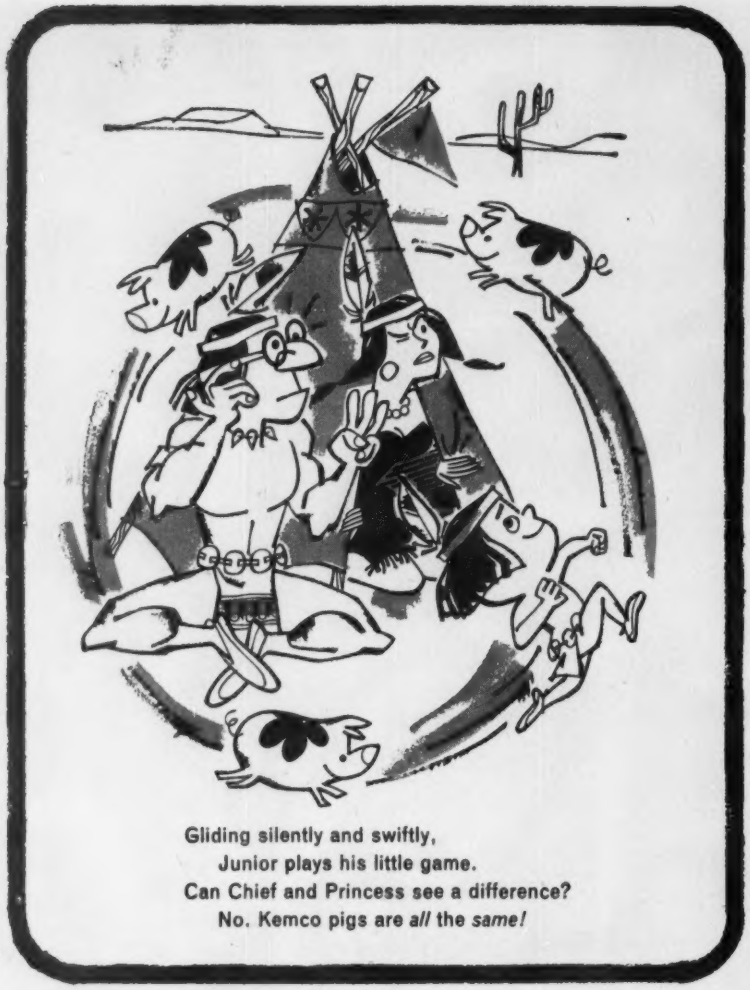

Gliding silently and swiftly,
Junior plays his little game.
Can Chief and Princess see a difference?
No. Kemco pigs are *all* the *same!*

When you think of SILICON . . . think of KEMCO!

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SILICON METAL - OTHER FERROALLOYS

Pig for pig, car for car,
Kemco uniformity *never* varies—
result—a consistently uniform melt.

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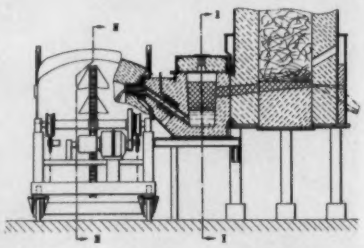
The superior form of silicon introduction . . . available in 60 and 30 lb. pigs and 12½ lb. piglets . . . In regular analysis or alloyed with other elements. For uniform high purity, aluminum producers specify Kemco Silicon Metal.

crete particles, and then a parting agent such as wax, calcium stearate, etc., is added. *Patent No.* 2,955,-336 *granted to J. S. Horn and J. M. Bleuenstein; said Bleuenstein assignor to Ford Motor Co., and said Horn assignor to American Marietta Co.*

Molten Metal Holder

Mixer for holding molten iron is arranged on a movable platform with means for tilting it so that the contents may be discharged into a pouring ladle. Opening is provided in one end for admittance of molten metal from a cupola. A pouring spout is located on one side for discharging the molten metal, and on the top is an opening for insertion of a burner to preheat the interior prior to admittance of the metal.

In conjunction with the mixing



vessel, the cupola is equipped with a siphon or front slagging device to separate metal from slag and to prevent the latter from entering the vessel. Discharge tube for molten metal is surrounded with an electric induction coil for adding additional heat to the metal. *Patent No.* 2,962,278 *granted to Walter Goetz and Erwin Buhrer, and assigned to Georg Fischer A. G.*

Sand Conditioner

Portable unit for conditioning molding sand for reuse includes a number of screens, a strong magnet for removing fine tramp iron, a clod breaker, and a water spray situated near the point of discharge. Three screens are used, arranged so that they are oscillated or vibrated to expedite the screening action. Third screen is of smaller mesh than the other two, and mounted at a slight angle.

Clods and tramp iron particles too large to pass through the screen move down the screen under the clod breaker which is formed of

Circle 628 on Page 39

3M Abrasives Boost Aluminum Grinding Output 50%

Cast aluminum transformer heads are manufactured here at National Aluminum's Peoria, Illinois, plant. Gates, risers, flashings and parting lines must be ground off prior to assembly. The abrasive belts in use—a standard glue-bonded type—were proving unsatisfactory: low production volume, excessive down time were keeping costs high.

After analysis of the operation, the 3M Representative suggested the use of tough, resin-construction "Three-M-ite" Resinbond belts, with a specific belt lubricant.

Now this difficult grinding job is done faster and better. National Aluminum reports a 50% increase in the number of units ground and a corresponding decrease in abrasive costs!

Why not let 3M's new COST CHECK 5-4-5 Program help you to effectively investigate ways to lower costs and increase production. Discover:

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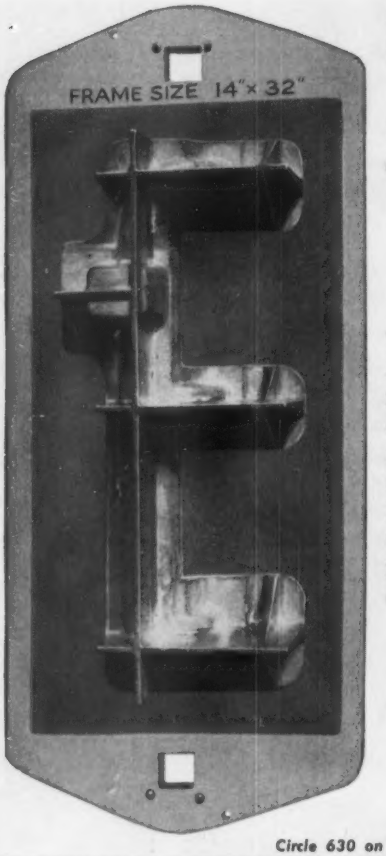

Let's talk profits!
Let's talk
increased production!
Let's talk about . . .

TAMASTONE

PATTERN COMPOUND

The Drier pattern at left is for air intake diesel manifold made from an original master pattern. *Only one skrinkage!* Material is aluminum. Pattern was used for 50 Driers. Only 3 hours labor and 35 pounds of TAMASTONE were required. Up to 1,000 castings have been made from a plate of this type!

No special skill needed to increase production 400% or more! . . . WRITE . . .

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TYPE 304 STAINLESS VIRGIN COMPONENTS		
5	Lbs. Manganese	$ 1.75
5	Lbs. Silicon	.95
265	Lbs. Ferro-Chrome 70%	64.00
90	Lbs. Nickel	66.60
1.5	Lbs. Calcium/Silicon	.39
635	Lbs. Ingot Iron	47.78
		$181.47

TYPE 304 STAINLESS PRE-ALLOYED FURNACE CHARGES

1000 LBS. $.14 LB.* $140.00

*Average price for type 304 paid first half year 1960

This comparison reveals a charge savings in excess of $40.00. Think of the additional savings in reducing the necessity of multiple purchase orders, freights, handling and storage. Time consuming **Charge Make Up** is eliminated also because Alloying has already been done for you.

For more information on type 304 Stainless Steel or other Nickel Alloys Contact
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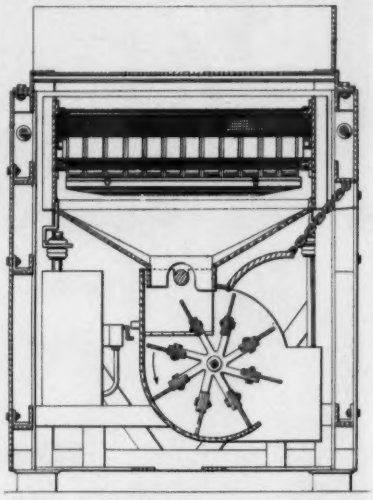
rubber tires mounted on a rotatable shaft. The breaker crushes the clods and forces the resultant product through a perforated panel. Large particles of tramp iron pass under the breaker and out of the machine.



Fine tramp iron is removed by a magnet below the screens. Cleaned sand is removed from the machine by a rotating paddle wheel. *Patent No. 2,959,830 granted to George Castera.*

Removes Burrs

Deburring of zinc-base diecastings is accomplished with an acid bath containing chromates, nitrates, weak acids, fluorine compounds, and strong mineral acid such as sulfuric. One specific mixture is a solution containing in 2 liters, 270 grams chromic acid, 115 grams nitric acid, 90 grams acetic acid, 131 grams hydrofluoric acid, 23 grams sulfuric acid, and remainder water. Bath temperature is 145° F, and treatment time 45 seconds. *Patent No. 2,955,-027 granted to I. L. Newell and E.A. Walen.*

Takes Out Hydrogen

Removal of hydrogen from copper, nickel, and alloys of copper and of nickel is accomplished by addition of materials which generate carbon dioxide such as dolomite or limestone. These materials are ground into powder or granular form, bonded with sodium silicate, and formed into suitable sized briquettes or blocks which are baked at 400° F for 6 hours to reduce the moisture content to about 0.12 per

Circle 631 on Page 39

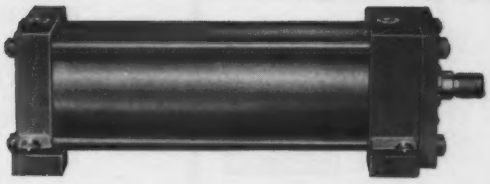
SAVE TIME, AIR, MONEY

with PARKER-HANNIFIN One Source Engineering

Your pneumatic system shapes up faster at the design stage when one man can discuss with you every component you'll need. But have you realized how much your Parker-Hannifin man can save you in money and air?

Just for instance . . . your valves don't have to be ¾" just because the cylinder size you select comes with ¾" ports. Your Parker-Hannifin man chooses valve types and sizes to suit the air flow you'll need. He'll show you too, how pressure control saves money and air, how a smaller lubricator is often a more efficient lubricator, and other money saving ideas. Then he'll show you ways to "tube up" and "hose up" a leakproof pneumatic system quicker, neater and at lower cost.

Call your nearest Parker-Hannifin sales office, or write direct for complete information.



Low friction, long packing life are money-saving features of the Hannifin Series "A" pneumatic cylinder, available in a full range of mounting styles and from 1½" to 14" bore, strokes to 20 feet. Hannifin cylinder application data and charts make selecting the right Series "A" cylinder easy. Get yours from your Parker-Hannifin man.

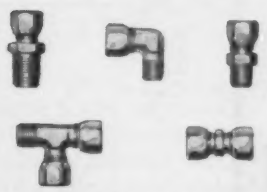
DUAL SOLENOID, 4-WAY

PRESSURE, 3-WAY

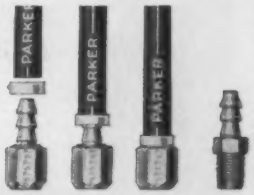
HAND, 4-WAY

CAM, 3-WAY

Use flow factors as money-savers—your Parker-Hannifin man can show you how. They help you to avoid "oversizing" your valves. Hannifin's new Valve Finder gives "Cv" ratings for every valve in the line, makes it possible for you to take full advantage of the extra air-flow capacity in Hannifin air valves. Get your copy today.

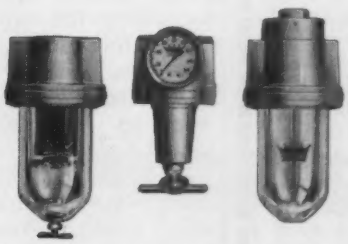


Pneumatic systems tube up fast with Parker "Intru-lok" tube fittings. Use them with copper, nylon or "Parker-POL" polyethylene tubing. Just insert the tube and tighten the nut for a leakproof "bite-type" joint.



Another time-saver is "Push-lok", the Parker hose-and-hose-fittings combination for pressures to 250 psi. No tools needed. Just push this hose on these hose fittings. They won't blow off, ever, not at twice 250 psi.

One air line connection installs the Hannifin Air Motor . . . an integral solenoid valve controlling a fast, rugged double-acting air cylinder. Built-in speed controls adjust piston speed in either or both directions.



You will save both air and money with Hannifin "Crown" air line filters, pressure regulators and lubricators. Let your Parker-Hannifin man show you how they pay for themselves by making it possible to get all the air flow you need at the exact pressure that will best do the job. "Crown" filters and lubricators will bring further savings through reduced equipment maintenance.

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HANNIFIN COMPANY
A DIVISION
637 South Wolf Road • Des Plaines, Illinois
PNEUMATIC AND HYDRAULIC SYSTEM COMPONENTS

3139-PH-a

Circle 632 on Page 39

SEND FOR CATALOG F

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DRESS SNAGGING WHEELS:

Coarse snagging wheels grind faster, last far longer when dressed regularly with a Desmond Heavy Duty dresser. Even on high-speed resinoid and rubber bonded wheels inexpensive Desmond mechanical dressers expose new, sharp grains and provide a fresh, unloaded surface. Desmond Hex and Huntington dressers are widely used on large and medium size vitrified and silicate wheels. Desmond dressers soon pay for themselves.

The only complete line of grinding wheel dressers and cutters

Desmond

Desmond-Stephan Mfg. Co.
Urbana, Ohio

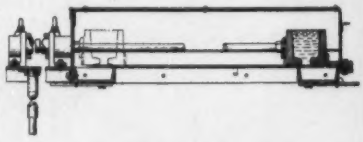
Circle 633 on Page 39

cent. Carbon also may be added to the powdered material prior to bonding. *Patent No.* 2,956,873 *granted to J. G. Emott, and assigned to Foundry Services International Ltd.*

Adhesive Depositor

This device provides a means for depositing liquid adhesive on parting line surfaces of shell molds. It consists of an open framework on which is a plastic template containing apertures drilled to accommodate specific areas on mold faces where the adhesive is to be deposited. A trough is mounted over the template in sufficiently close contact with it so that the adhesive will not seep out at the interface.

The trough is arranged so that it



may be moved across the template from one end to the other by an air cylinder. Rate of movement of the trough and the size of the holes in the template permit the correct amount of adhesive to be deposited on the mold surface. Weight of the trough is sufficient to cause a squeegee action which removes any film deposit on the template on the next pass. *Patent No.* 2,961,946 *granted to Alfred C. Quist and assigned to Shell Process Inc.*

Steelmaking Method

Procedure for producing steel low in nitrogen from molten pig iron includes a rotatable cylindrical drum for holding the metal. Oxygen is injected below the surface by a tube or tuyere, and non-heated air is blown above the bath surface to burn up the carbon monoxide formed.

In an example cited, 56,000 kg of pig iron was converted into steel with a nitrogen content of 0.004 per cent in a total time of 130 minutes of which 70 minutes was devoted to blowing with 80 per cent oxygen. Oxygen consumption was 60 cubic meters per metric ton. *Patent No.* 2,959,479 *granted to R. E. Graef and assigned to Huettenwerk Oberhausen A. G.*

PQ's extensive line of soluble silicates (over fifty) offers the products needed for dozens of industrial processes.

A few PQ Silicates which may have special interest to you:

N . . . Ratio $\%Na_2O:\%SiO_2$, 1:3.22, 41° Baume (68°F.), viscosity 1.8 poises.

K . . . Ratio $\%Na_2O:\%SiO_2$, 1:2.90, 47° Baume (68°F.), viscosity 9.6 poises.

RU . . . Ratio $\%Na_2O:\%SiO_2$, 1:2.40, 52° Baume (68°F.), viscosity 21.0 poises.

D . . . Ratio $\%Na_2O:\%SiO_2$, 1:2.0, 50.5° Baume (68°F.), viscosity 3.5 poises.

PQ silicates have been produced for a century. You are welcome to draw on this long experience.

When you need silicate service, see PQ.

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1062 Public Ledger Bldg., Philadelphia 6, Pa.

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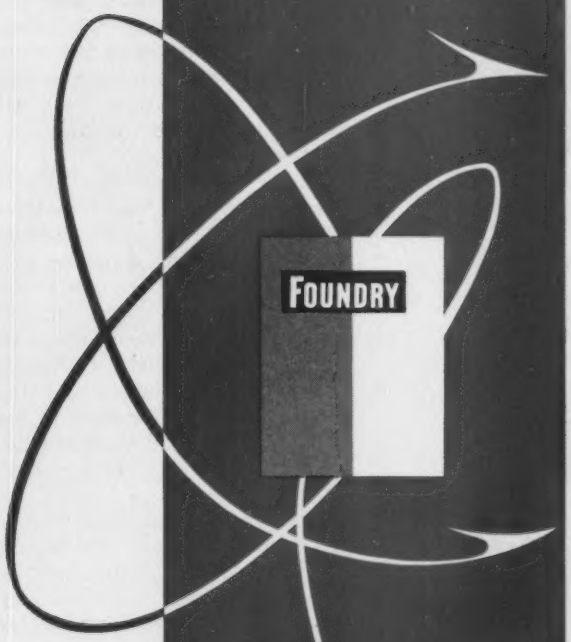
PQ SOLUBLE SILICATES

Associates: *Philadelphia Quartz Co. of California Berkeley & Los Angeles, California; Tacoma, Wash. National Silicates Limited, Toronto & Valleyfield, Canada.*

PQ PLANTS: ANDERSON, IND.; BALTIMORE, MD.; BUFFALO, N.Y.; CHESTER, PA.; JEFFERSONVILLE, IND.; KANSAS CITY, KANSAS; RAHWAY, N.J.; ST. LOUIS, MO.; UTICA, ILL.

Circle 634 on Page 39



SPECIAL EDITORIAL REPORT

Meeting Competition Through Improved Foundry Technology

By taking advantage of latest developments in casting practice, foundrymen will be better able to capture a growing share of the highly competitive market for engineering materials.

To dramatize these developments, the editors of FOUNDRY will present another special report to the metal castings industries. This year's report will detail recent technical and operating advances of the industry, as applied to these metals: Gray Iron . . . Aluminum . . . Steel . . . Brass and Bronze . . . Malleable Iron . . . Magnesium . . . and Zinc. This important presentation will appear in the May 1961 . . . .

Pre-Convention Issue

It will be published just before the 65th Castings Congress of the American Foundrymen's Society in San Francisco, May 8-12.

Leading metal-casting authorities are preparing reports for this noteworthy editorial package. Progress and developments to be discussed, among other things, will be in the following areas of foundry practice: Casting design, casting cleaning, diecasting, melting methods and equipment, material handling, and sand technology as affected by molding and coremaking equipment and methods and new types of sand binders. Also, metals technology as affected by new alloys, heat treating methods and equipment, and melting methods and equipment.

In addition to these discussions, which will constitute an important contribution to foundry know-how . . . the May Pre-Convention issue will present program details on the Convention along with all the regular editorial departments.

a Penton *publication*

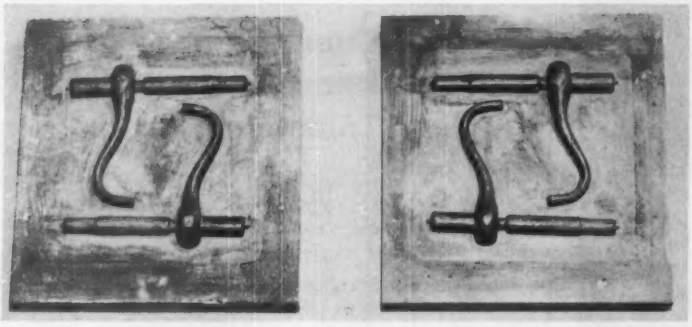
FOUNDRY

The Business Magazine of Metal Casting

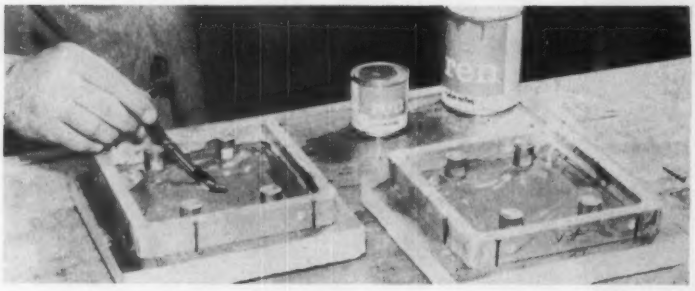
PENTON BUILDING • CLEVELAND 13, OHIO

Plastic Saves Time in

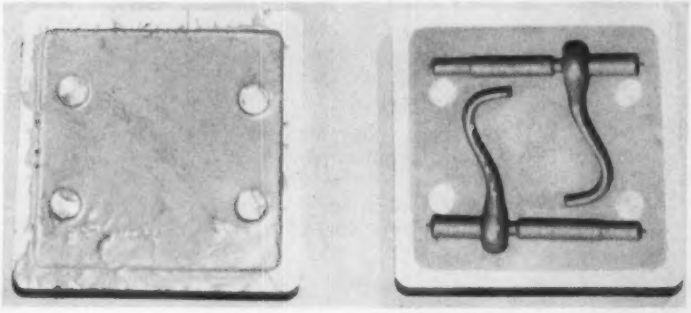
Duplicating Coreboxes



Making a plaster cast of each half of the corebox, such as shown here, is the first step in producing duplicates from epoxy resin

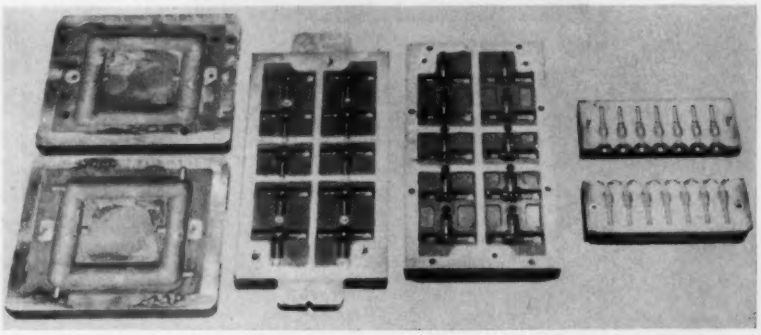


After aluminum frames and bushings have been mounted, casts are coated with release agent. Then, a layer of resin is brushed on



View shows backside and core cavity of an epoxy resin corebox. Note aluminum bushings to be fitted with closing dowels

Three plastic coreboxes can be seen here. Dowels, blowholes, and vents have been fitted



● USE OF EPOXY RESIN plastics is saving up to two-thirds of the time formerly required to construct coreboxes at Wolverine Brass Works, Grand Rapids, Mich.

Coreboxes formerly were duplicated in gray iron or aluminum when masters were not available. This method normally took five days, or about 50 hours of labor, depending on size and configuration of the box. Duplications were started at the blueprint stage and necessitated layout to the exact configuration desired.

Plastic Requires One Day— When epoxy resin was introduced at Wolverine Brass about three years ago, the same coreboxes were duplicated in one day, not counting curing or setting time, for a 75 to 80 per cent saving in labor, according to Frank Steketee, foundry superintendent. These results with plastic have been repeated at the company in the duplication of about 20 coreboxes during the last three years.

Make Plaster Cast—First step in the duplication of a corebox in plastic is to take a plaster cast from an existing corebox or a box furnished by the customer. The plaster shape represents the core. Any discrepancies in the original box as the result of breakage or wear are corrected quickly with plaster or wax. The plaster cast is cured overnight at 300° F in an infrared oven.

Release Agent Necessary — The plaster then is treated with several coats of a release agent to prepare it for mounting. Three coats of the release agent are brushed or sprayed over the plaster and followed by two coats of a grease-type parting. Each coat is rubbed into the surface, leaving a uniform,

Circle 636 on Page 39→

"P-L-E-A-S-E, Dear Koppers..."

That guy Satan is a persistent devil all right. He's called a dozen times begging to buy some of our Koppers Premium Foundry Coke. It's kinda hard to keep saying no, because *he* says business is good down there and he wants to place a big order.

But business is good up here, too. Apparently the word has been getting around that Koppers Foundry Coke keeps operating costs way down and maintains a higher temperature range.

The reasons are these: Koppers Coke is prepared from the best quality West Virginia coals, carefully blended and baked the right length of time. It's absolutely uniform in *size, strength, structure* and *chemical analysis.* We check each day's run to be sure.

And because of its superior physical qualities, high carbon and low ash, Koppers Coke enables foundrymen to maintain higher temperatures which increases the cleanliness of the iron and helps to reduce fuel consumption.

No, we're still not going to sell Brother Satan—but we'd sure like to sell you. Why not make your next order Koppers Premium Foundry Coke? Available anywhere in the U.S. or Canada, it's sized to fit your needs. Koppers Company, Inc., Pittsburgh, Pennsylvania.

Koppers Premium Foundry Coke

A very pertinent and timely message addressed to Purchasing Agents and Superintendents of Steel Mills, Foundries and Metalworking Plants:

IT ISN'T NECESSARY TO PAY

$55 TO $75 MORE PER TON FOR STEEL SHOT AND GRIT...

because YOU CAN GET EQUALLY GOOD PERFORMANCE* WITH "SUPER-STEEL" *for only*

$165.00

PER TON

in truck loads

* "SUPER-STEEL" *is unequivocally guaranteed to equal the performance of any of the higher priced steel abrasives now on the market!*

Worth investigating? Sure it is! Write, wire or phone (collect) for more information—or a trial order.

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ALSO IN: Chattanooga • Chicago • Cincinnati • Dayton • Detroit • Elberton, Ga. • Grand Rapids • Greensboro, N. C. Houston • Los Angeles • Louisville • Milwaukee • Minneapolis • New York • Philadelphia • Pittsburgh and St. Louis.

MANUFACTURERS, ALSO, OF TOP QUALITY "SEMI-STEEL" SHOT AND GRIT, MALLEABLE AND CHILLED SHOT AND GRIT — AT COMPARABLE SAVINGS!

greaselike surface which prevents the epoxy resin from sticking to the plaster. Next, the aluminum frame and bushings are mounted on the plaster securely to avoid movement or the chance that plastic will run under the form later.

Laminating—A surface coat then is brushed over the plaster to a thickness of approximately 1/32 in. After about one hour of curing at room temperature, the job is ready for lamination. Usually, a laminating mix is used with fiberglass cloth for two laminations. The number of laminations can vary, however, with depth of the cavity.

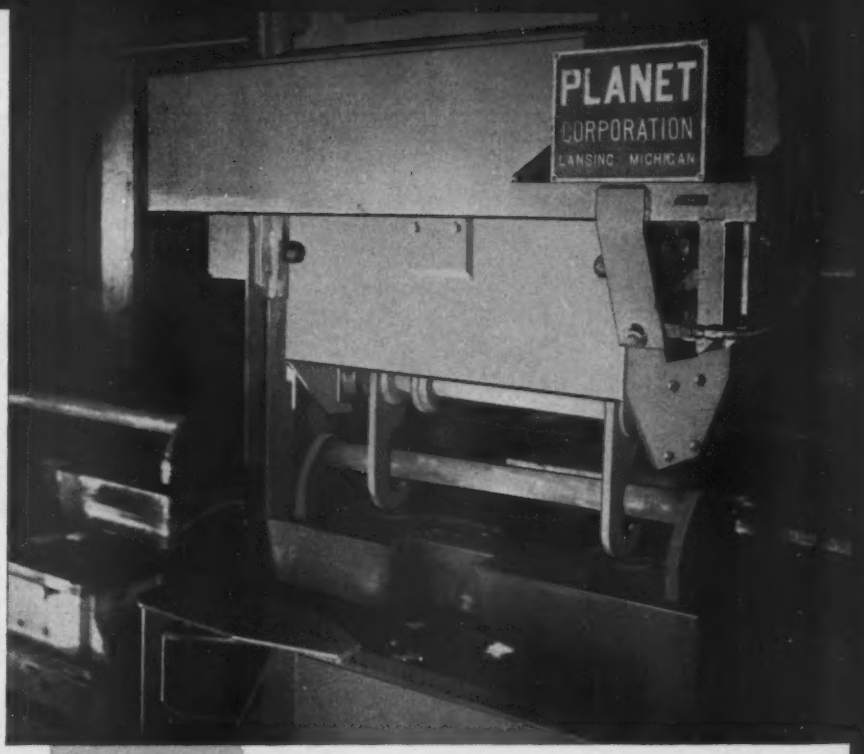
Lamination is followed by curing at room temperature, ordinarily overnight, and the cavity of the corebox then is filled to the top of the aluminum frame with ½-in. layers of cast plastic. After curing and cooling to room temperature, the corebox is ready for use, subject to rigging for the core machines.

Corebox Life—Each plastic box is considered to have a production lifespan, in use, practically equal to that of an iron or aluminum corebox. In addition, the plastic box is light and can be rebuilt or repaired easily.

Epoxy resin has proved successful because of its strength and its ability to bond to other materials. Smooth surfaces of the plastic box facilitate release from sand with the use of lubricants. Other advantages include dimensional stability, impact resistance, wetting ability, chemical resistance, and abrasion resistance.

Plastic used by Wolverine is produced by Ren Plastics Inc., Lansing, Mich.

"The safety committee has this special award to pin on you when you get back to work"



Weight-Shifter, at International Harvester's Indianapolis Truck Engine Works, automatically places weight on mold.

PV
FINDS A NEW WAY TO DO AN OLD JOB...

PLANET WEIGHT-SHIFTER* SPEEDS PRODUCTION, SAVES LABOR BY ELIMINATING HAND CLAMPING

*Patent Pending

Planet Corporation's Weight-Shifter eliminates clamping or manual handling of weights by gently placing weights on top of molds and later removing them . . . this completely automatic operation, capable of accommodating 400 molds per hour, saves time and labor.

As a mold approaches the Weight-Shifter it trips a switch which activates the loader mechanism. The loader hook carriage engages a weight, elevates it, swings it out, and gently and accurately places it on a passing mold. After pouring, the mold passes by the rear end of the Weight-Shifter where the weight is retrieved by a similar operation. The retrieved weight is set on a conveyor within the machine to be carried to the loading end ready for reuse.

The Weight-Shifter is flexible . . .it can be installed on an old line as well as on a new line. Weight discharge height, weight size, vertical dimension, and speed of operation can be adjusted to fit any foundry's operation.

This new way to do an old, manual job is a product of "PV" . . . *Planet Versatility* . . . the quality that has made Planet Corporation known throughout the foundry industry as an organization with solutions to production, materials handling and automation problems. Write or phone for more information about the Weight-Shifter today.

PLANET CORPORATION
1818 SUNSET AVENUE
LANSING, MICHIGAN

- Engineered Handling Equipment
- Automation Equipment
- Mill & Foundry Handling Equipment

95

Circle 638 on Page 39

Progress in metals . . . a key to America's bountiful breadbasket

A revolution occurred in American agriculture when industry began fashioning farm implements largely from iron and steel. Giant metal combines began harvesting a hundred acres of wheat far faster than a dozen farm hands could harvest a single acre. Today, the farmer's ability to wrest more and better foods and fibers from the soil has again increased many fold over just a few short decades ago. And again, largely due to modern farm machinery made more rugged and dependable by improved gray iron castings and higher strength steels.

Pittsburgh Coke & Chemical Company, through its Coke & Iron Division, is one of the nation's leading merchant producers of high quality metallurgical coke and pig iron for the gray iron foundry industry—and of ferromanganese, an indispensable alloy in every ton of steel the nation produces.

The Coke & Iron Division is one of four service-conscious subsidiary organizations of Pittsburgh Coke & Chemical Company—a basic producer dedicated to help your company produce *a better product . . . at a better profit.*

COKE & IRON DIVISION

PITTSBURGH COKE & CHEMICAL CO.

GRANT BUILDING • PITTSBURGH 19, PA.

Cars Use More Malleable, Mg, Al Castings

Detroit—Automobiles will contain more aluminum, more magnesium, and more malleable iron, say industry forecasters. Aluminum Co. of America says the average 1961 auto uses 62.8 lb of aluminum. That is 8.4 lb more than used last year. The Oldsmobile F-85 is the biggest user with an average of 159 lb. The average 1965 car will contain an estimated minimum of 115 lb of aluminum.

The F-85 also uses more malleable iron than any other U. S. auto. It averages 152 lb, and some models carry up to 164.5 lb. The average 1961 car will use over 100 lb of malleable castings compared with 97 lb in 1960, says the Malleable Founders' Society.

Dow Chemical Co. foresees the use of more than 10 lb of magnesium per car by 1965. That could be die-castings in automotive engines, transmissions, and structural interior components.

Boston—Gray and malleable iron foundries in New England limp along with small backlogs. Most companies also are caught in a price squeeze, with unit costs still tending upward. Installation of more efficient equipment has not entirely balanced higher costs, and foundrymen are absorbing part of the increase and operating on a narrow margin.

First quarter backlogs of iron foundries are small. Orders are spotty, and prompt delivery usually is specified. One bright spot is that consumer inventories also are low; only a moderate improvement in demand for finished products requiring castings would be needed to be reflected in foundry output.

Machine tool volume has been disappointing; some shops expected a mild improvement by the year-end, but it has not yet appeared. Few iron foundries are operating as much as four days per week and in most cases with short crews. Although one malleable shop had its best year in 1960, this is an exception, and so far this year backlogs have slumped.

Raw materials are in ample supply, with prices holding except on scrap. Foundry coke now is based at New Haven, Conn., to New England consumers at $31 f.o.b. plant. Most foundries are spreading their pig iron orders among several suppliers, with Troy, N. Y., the nearest base. Consumers are concerned in maintaining the base at Troy to avoid higher freight costs. Buffalo-produced iron is being sold to meet the delivered price from Troy, and some southern iron is being stockpiled for sale at Providence, R. I.

Nonferrous shops are only slightly more active than gray iron producers, although shipyards are expected to supply more orders this year. Volume of aluminum business in electronic parts is somewhat above the average. Stocks of brass and copper castings have been worked down by both consumers and producers; in some cases these inventories were heavy during the last six months, 1960.

Philadelphia—Following a sluggish January (though slightly better than December), casting producers see a little more activity ahead. More demand for pipe and building requirements is in prospect as spring approaches.

Industrial equipment demand is a shade livelier; there is more electrical machinery work and, in this immediate area, more ship work. Tobacco processing equipment and

COKE DISCUSSED: Good foundry coke was the subject of discussion by officers of the New England and Connecticut chapters, AFS, and officers of the host Connecticut Coke Co. during a visit by the foundrymen to the company's New Haven, Conn., plant. Left to right are Larry J. Litalien, Waterbury Farrel Div., Textron, Inc.; Stafford W. Chappell, Electric Boat Div., General Dynamics Corp.; Lewis Greenslade, Jr., Brown & Sharpe Mfg. Co.; Thomas Thibeau and Edward L. Flahive, Connecticut Coke Co.; and C. Russell Walton, Eastern Gas & Fuel Associates

material handling machinery are slightly more active, but textile and paper machinery requirements show no early promise.

At the moment most foundry operations are slow. Gray iron job shops are operating around three to four days a week, with backlogs averaging possibly two weeks. On a percentage basis, these foundries are producing at close to 60 per cent of normal operations (for a single shift).

Steel casting demand remains limited. Most shops are running three to four days a week and can make relatively quick delivery, considering the processing involved. Shipments average four to five weeks. Cargo ship construction at the Sun Shipbuilding & Dry Dock Corp. yard at Chester, Pa., will stimulate some buying within the next few weeks.

Malleable activity in no way resembles that of a year ago. At that time business was brisk and backlogs were heavy. Volume continued heavy through the first half but since then has been in a relative slump. Producers are beginning to cast more fittings, principally for stock, and anticipate an early upturn in building and electrical hardware. They are operating three to four days a week.

Brass shops claim their business has no way to go but up. At least some say it is almost that bad. Operations of three days a week appear to be the maximum for most jobbers.

Possibly the brightest situation is in electrical equipment. The captive shop of one large builder is subletting work to independent foundries, which also are benefiting from specifications from another large district builder which has no foundry of its own. Outlook in plumbing supplies and meters is more encouraging, with the more active building season not far off. Light metal foundries continue to do well.

The Chester, Pa., furnace of Phoenix Steel Corp. is expected to resume operations late in February after a suspension of a number of months. It will supply hot metal to the Phoenix plate mill at Claymont, Del., but is believed likely to have some tonnage for the merchant trade.

Chicago— Failure of 1960 castings sales to come up to the bullish predictions made a year ago is causing foundrymen to be wary in accepting forecasts for 1961.

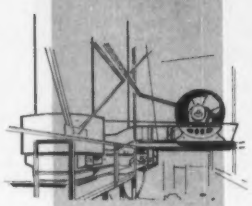
The outlook in most capital and consumer goods fields ranges from a standoff from 1960 to a modest increase. In major Midwest markets for castings the outlook is as follows:

Farm machinery—up 5 to 10 per cent. Construction equipment—small but progressive gains through the first half. Appliances—up 3 to 5 per cent. Railroads—reduced requirements for both freight cars and maintenance. Automobiles—down from 6.7 million cars in 1960 to 5.8 million. The second half looks more promising than the first half.

Foundry operations currently are spotty, varying from full schedules to three or four days a week. January is expected to be the year's low month, but an increase in inquiries is encouraging.

SPENCER

famous in foundries



Familiar to foundrymen . . . and held in high regard . . . are these well known Spencer products:

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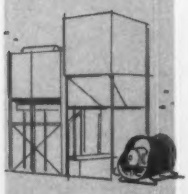
By far the first choice of cupola manufacturers . . . and for replacement. Rugged, reliable units in a full range of capacities from ⅓ to 1,000 H.P.; up to 20,000 C.F.M.; 4 oz. to 10 lbs. pressure.

VACUUM CLEANERS

Heavy duty units built to handle the tough cleaning assignments. Sizes from 1½ through 15 H.P.



BLOWERS ON SAND RECLAIMERS

Performance proven units that are first choice of leading reclaiming equipment makers.

Request descriptive literature or the name of the Spencer representative in your area.

Catalog No. 126C describes Spencer blowers; Catalog No. 155B provides information on Spencer industrial vacuum cleaners.

The SPENCER TURBINE COMPANY
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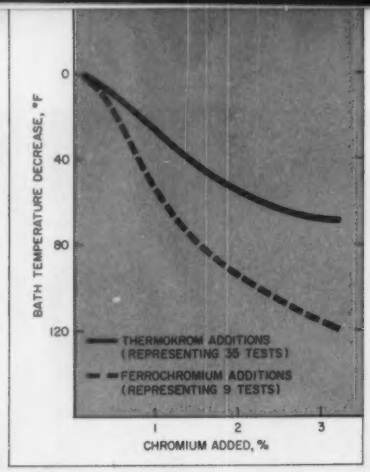
Circle 641 on Page 39



Graph compares temperature drops in melts of iron and steel after additions of chromium as ordinary ferrochromium and an exothermic ferrochromium mixture

Advantages of Ladle Additions of EXOTHERMIC FERROCHROMIUM

Chromium content in steel can be adjusted in the ladle by adding exothermic ferrochromium, which disperses the alloying agent throughout the melt

By ROBERT L. MICKELSON
Assistant Project Engineer
Vanadium Corp. of America
New York

● INCONSISTENT chromium recovery, excessive temperature loss, and slow solution time are the major problems encountered while alloying steel with standard grades of ferrochromium.

This alloying agent normally is added to steel in the furnace because ladle additions chill the melt too much and dissolve too slowly. Ferrous oxide in slag oxidizes chromium, and differences in slag composition produce efficiency variations and off-grade heats.

One answer for steels to which moderate amounts of chromium are to be added appears to be the use of exothermic ferrochromium. This material is available in steel cans containing a specific weight of chromium. The cans are added to steel in the ladle during the tapping operation, thus avoiding oxidation by the furnace slag.

A Bonded Mixture — Exothermic ferrochromium is a mixture consisting essentially of ferrochromium, an oxidizing agent, and a reducing agent. The reducing agent must be a material that is more easily oxidized than the chromium. When an exothermic mixture is added to a metal bath, a heat-producing reaction occurs. The mixture usually is bonded to prevent dispersion of its ingredients into the melt prior to this reaction. Upon reaching a specific temperature, the bonding agent decomposes and allows the alloying element to be suddenly dispersed throughout the molten metal.

One exothermic ferrochromium mixture is Thermokrom, which contains sodium nitrate as an oxidizing agent, ferrosilicon as a reducer, and an organic bonding agent. This material is made by Vanadium Corp. of America. When a can of this mixture is added to molten steel, heat is absorbed and when the temperature within the can rises to approximately 800° F, the reaction proceeds. The steel container dissolves, the bonding agent decomposes, and the chromium absorbs heat as the silicon is oxidized. Thus, the addition is dispersed throughout the melt.

Nominal Composition of Melts

	Melt	% C	% Mn	% Si
Temperature Loss Tests	Steel	0.40	0.90	0.30
	Iron	3.50	0.70	1.90
Recovery Tests	Steel	0.10	0.35	0.60

To study exothermic ferrochromium materials, an extensive research program was conducted by the Vanadium Corp. Optimum particle sizes, the most suitable bonding agent, and the most desirable composition were determined by evaluating numerous experimental mixtures. Bath temperature decreases caused by additions of the experimental alloys to iron and steel melts were measured. Chromium recoveries from various compositions were determined, and comparative solution rates were observed. Performance of exothermic ferrochromium in comparison to a standard grade of ferrochromium is illustrated in the accompanying graph.

Test Procedures—Temperature effects of exothermic ferrochromium additions to a metal bath were determined by utilizing a 300-lb capacity high-frequency induction furnace as a calorimeter. Steel and gray iron melts with nominal compositions, shown in the table, were heated to approximately 2800° F and 2650° F, respectively. A thermocouple was secured to the furnace, with its hot junction immersed 2 in. below the bath surface, and temperatures were measured by a recorder. Furnace power was adjusted to provide constant bath temperature.

The melt was deoxidized with aluminum. Chromium was added as either regular or exothermic ferrochromium alloy, sized at eight mesh by down. Chromium additions of 0.5 and 1.0 per cent were made to steel, and additions of 0.33, 1.0, and 3.0 per cent chromium were made to gray iron. All additions were contained in thin sheet steel cans which were held just below the bath surface until they dissolved and the contents had dispersed into the melt. Change in bath temperature resulting from

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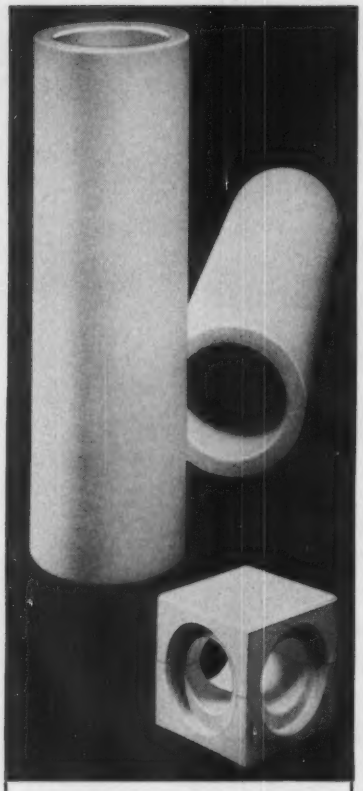

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each addition was charted by the recorder. Since the increased chromium content that resulted from each addition to a melt did not cause measurable variations in temperature loss, three or four tests were usually made in each heat.

Chromium recovery data were obtained from nine 300-lb induction-furnace steel heats. Nominal composition of the steel is shown in the table. Each heat was tapped at 2950° F into a ladle containing a 1 per cent addition of chromium as exothermic ferrochromium. Samples for chemical analyses were taken from the tap stream leaving the furnace and from the pouring stream as the steel was teemed into ingots.

Chromium contents of the various batches of exothermic ferrochromium used in this investigation approximated 53 per cent. Batches containing nominally 8, 4, and 0.40 per cent carbon were added to heats from which temperature data were obtained, but temperature effects seemingly were not influenced by the carbon content of the exothermic material. Consequently, no distinction between the various batches is made in this article.

Ferrochromium employed in temperature loss tests contained 64.9 per cent chromium, 2.7 per cent silicon, and 4.4 per cent carbon. All recovery tests were made with exothermic ferrochromium containing 4 per cent carbon.

Results — Approximately 50 per cent less bath temperature decrease occurred when chromium additions were made as exothermic ferrochromium rather than as regular ferrochromium. Results indicate that composition of the melt, whether it was steel or gray iron, did not measurably influence the temperature decrease resulting from an addition.

Chromium recoveries from the exothermic material ranged between 95.0 and 99.7 per cent and the reaction was completed quickly with very little smoke.

Conclusions—These tests showed the benefits attainable through use of an exothermic ferrochromium mixture. Temperature advantage from exothermic ferrochromium is evident from the graph. This advantage allows twice as much chromium to be added to a ladle of steel without causing a skull.

Chromium recoveries ranging between 95.0 and 99.7 per cent were obtained in this investigation. Recoveries that approximate 95 per cent are reported by various steel producers who use exothermic ferrochromium. Rapid solution rate and superior chromium recovery, characteristic of this material, seemingly merit its consideration as a chromium source for numerous grades of steel.

Book Review

Exploring Patternmaking and Foundry, **by Harvey D. Miner and John G. Miller, cloth, 206 pages, 6 x 9⅛ in., published by D. Van Nostrand Co., Princeton, N. J. Price $4.85.**

The text has been prepared for beginners in the patternmaking and foundry trades and provides basic information of operations in both fields. The authors give detailed instruction for performing each step in the working out of a number of projects. For example, under patternmaking projects, the student is given data on the construction of an elementary pattern, and procedures for constructing a split pattern. A series of drawings present elementary projects, cored projects, and assembled projects.

In addition to material on both patternmaking and foundry equipment and practices, data are presented on safety. A glossary of terms and other useful information, such as comparative weights of castings, also are included.

Mr. Miner is instructor in industrial arts, Bowling Green State University, Bowling Green, Ohio, and Mr. Miller is associate professor of education and director of instructional shops, New York University.

This text contains much useful information on the layout, construction and operation of the school foundry. It is to be regretted, however, that the authors have not included brief information that would give the student some idea of the methods and equipment used in the commercial foundry. For example, all of the discussion pertains to bench molding.

The hand squeeze method of testing the temper of molding sand is shown, but the fact that machines are available for making a variety of tests on sand is not mentioned.

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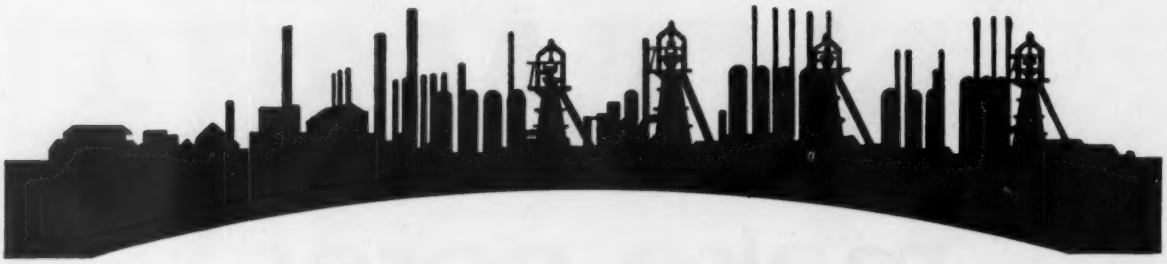

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BENJAMIN J. IMBURGIA
. . . GIFS field secretary

GERALD LEWIS
. . . Cooper Alloy Corp. v. p.

EDWARD RESENER
. . . joins Dean Bros. Pumps

Howard W. Brandt has been appointed vice president and group executive, National Malleable & Steel Castings Co., Cleveland, in charge of the Industrial Div. He will also direct Grand Rapids Plating Co., and Grand Rapids Die Casting Co., Grand Rapids, Mich., and Hill Hubbell Co., Cleveland, company subsidiaries. Mr. Brandt was vice president of the Hydreco and Aurora Divisions, New York Air Brake Co., New York.

Benjamin J. Imburgia has been appointed field secretary for the Gray Iron Founders' Society, Cleveland. In charge of general promotional activities, his duties will include membership building and maintenance, programing meetings, and organization of new groups. Mr. Imburgia was manager of the Tidewater Better Business Bureau, Norfolk, Va.

Donald R. Hepler has joined Brillion Iron Works Inc., Brillion, Wis., as foundry division manager. He was vice president-manufacturing, Cooper-Alloy Corp., Hillside, N. J.

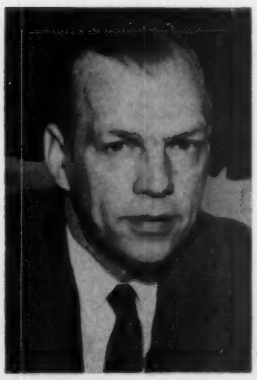
Ralph Tomlin has been appointed Wisconsin sales representative for the foundry department of Frederic B. Stevens Inc., Detroit. He was foundry superintendent, Berntsen Brass & Aluminum Foundry, Madison, Wis.

Gerald Lewis has been named vice president of marketing and engineering, Cooper Alloy Corp., Hillside, N. J. He will co-ordinate production and sales department activities and be responsible for new product development.

Edward Resener, formerly with C & G Foundry & Pattern Works, Indianapolis, has joined Dean Bros. Pumps Inc., Indianapolis, as sales manager of the foundry division.

John E. Gotheridge, Hackensack, N. J., has been appointed eastern regional sales manager, Foundry Services Inc., Cleveland. He has been technical service manager since 1956.

Frederick C. Irving Jr. has been appointed manager of casting sales, Aluminum Co. of America, Pittsburgh, succeeding **W. R. Butler**,



DONALD R. HEPLER
. . . joins Brillion Iron Works

RALPH TOMLIN
. . . Frederic B. Stevens sales

JOHN E. GOTHERIDGE
. . . Foseco regional mgr.

FREDERICK C. IRVING JR.
. . . casting sales mgr.

. . . MEN of INDUSTRY

A. J. KIESLER
. . . U. S. delegate to IFC

WILLIAM T. ELLISON

JAMES J. SCHWALM
. . . Archer-Daniels-Midland foundry sales promotions

who was named manager of the sales development divisions. Mr. Irving, who joined Alcoa in 1939, has been technical manager of castings sales.

A. J. Kiesler has been chosen by the American Foundrymen's Society to present its official exchange paper, "Desulfurization of Carbon Steel to Extra-Low Limits in the Basic Electric Furnace," at the International Foundry Congress to be held in Vienna, June 18-24. Mr. Kiesler is a metallurgist at the General Electric Research Laboratory, Schenectady, N. Y.

Harold H. Miller has been appointed general superintendent in charge of the engine plant and foundry operations, Buick Motor Div., Flint, Mich. **Donald J. Christensen,** general assistant superintendent, becomes superintendent of the engine plant, succeeding **Raymond L. Barton,** who has been assigned to the general manufacturing manager's staff. **Glen W. Cline Jr.,** formerly general foreman and assistant maintenance superintendent, takes over Mr. Miller's former duties as foundry superintendent.

Philip A. Gaebe has been appointed product manager of refractories, Kaiser Refractories & Chemicals Div., Kaiser Aluminum & Chemicals Sales Inc., Oakland, Calif. He was assistant general sales manager of the eastern division in Pittsburgh. **Harold B. Davidson** has been named assistant to the general manager of the eastern division in Pittsburgh. **A. S. Arcari,** assistant manager, has succeeded Mr. Davidson as manager of sales service for the division.

Portus M. Wheeler has been named vice president and general manager, Indiana Steel Products Div., Indiana General Corp., Valparaiso, Ind. He was vice president of sales for the division.

L. W. Kunkler, formerly assistant manager of engineering services for the Cleveland district, Air Reduction Sales Co., Div. of Air Reduction Co., New York, has been named district manager of the Buffalo office. He succeeds **R. H. Merriman,** who has been transferred to Airco's Philadelphia office.

Ralph D. Brizzolara, since 1943 vice president, American Steel Foundries, Chicago, has retired after 41 years of service. He will continue as a director. Mr. Brizzolara has been in charge of the company's Hammond Div., Hammond, Ind., Elmes & King Div., Cincinnati, and Pipe Line Service Corp., Franklin Park, Ill., a company subsidiary.

James J. Schwalm, formerly eastern division sales manager, Federal Foundry Supply Div., Archer-Daniels-Midland Co., Cleveland, has been named foundry sales manager. **William T. Ellison** has been appointed assistant foundry sales manager. **Guy Wolcott** replaces Mr. Ellison as sales representative in the Tri-City area. **Arthur Penters** has been transferred to the Milwaukee area. **J. Alex Dunn** succeeds Mr. Penters as sales representative in the western Michigan district.

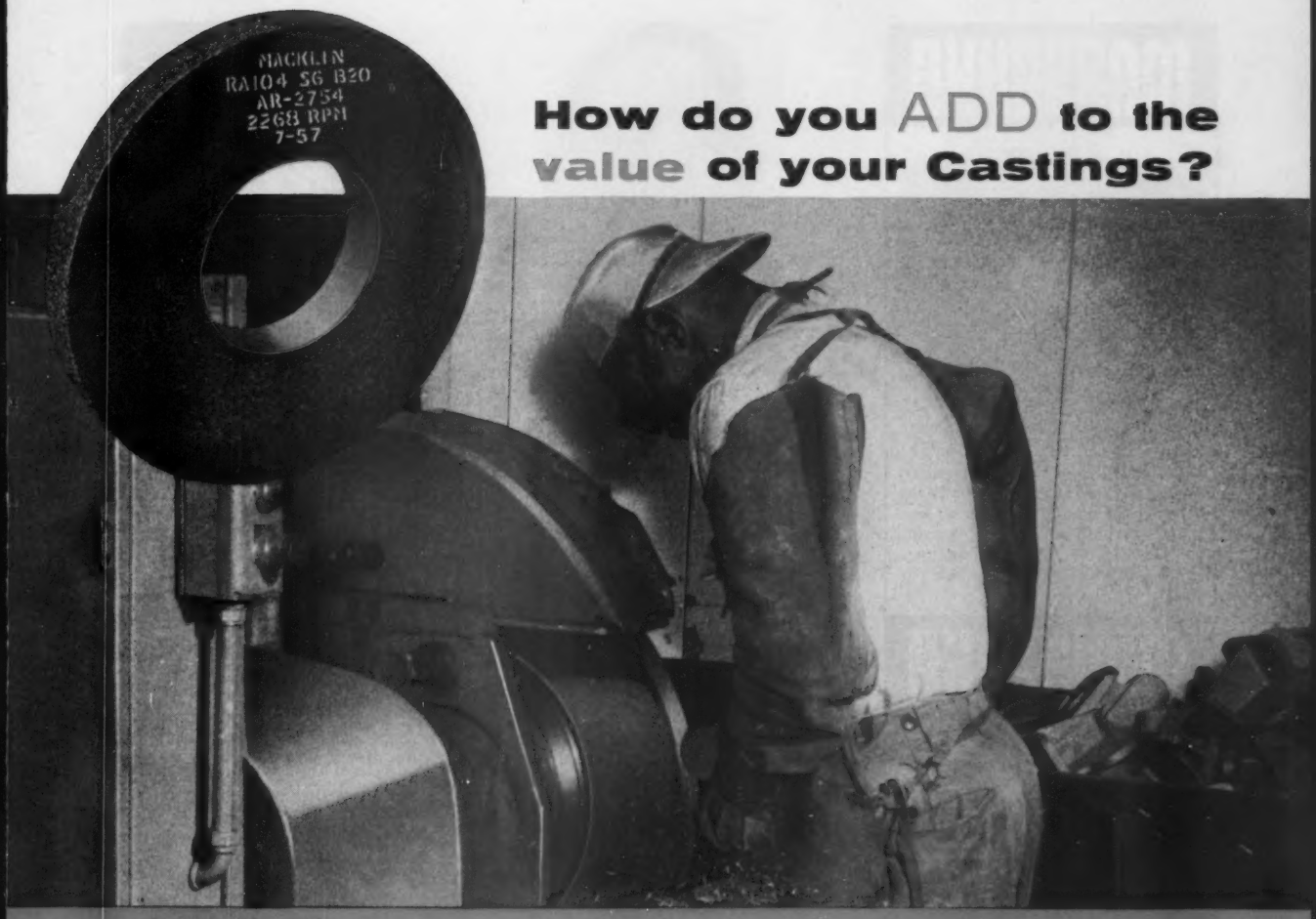
David W. Boyd has been named executive vice president, Engineering Castings Inc., Marshall, Mich. **J. Raymond Mohlie,** until recently

PHILIP A. GAEBE
. . . refractories product mgr.

J. ALEX DUNN

GUY WOLCOTT

ARTHUR PENTERS
. . . Archer-Daniels-Midland appointments



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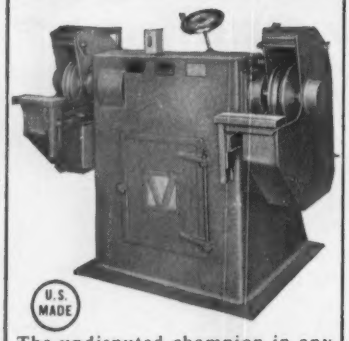

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WILLIAM J. MILLER
. . . heads AFS Chapter

vice president of engineering, Rich Mfg. Corp., Battle Creek, Mich., succeeds him as vice president and general manager. Mr. Boyd will continue as sales manager.

William J. Miller, chairman of the Northwestern Pennsylvania Chapter of the American Foundrymen's Society for 1960-61, is sales representative for Frederic B. Stevens Inc., Erie, Pa., with whom he has been associated since 1938. Previously he was with Erie Malleable Iron Co. for many years.

Fred J. Pfarr, formerly plant manager, Lake City Malleable Co., Cleveland, has joined Hines Flask Co., there, as sales representative. A former chairman of the Northeastern Ohio Chapter of the American Foundrymen's Society, he also served as a director of the national organization.

Gerald J. Grott has been appointed technical manager, WaiMet Al-

FRED J. PFARR
. . . joins Hines Flask Co.

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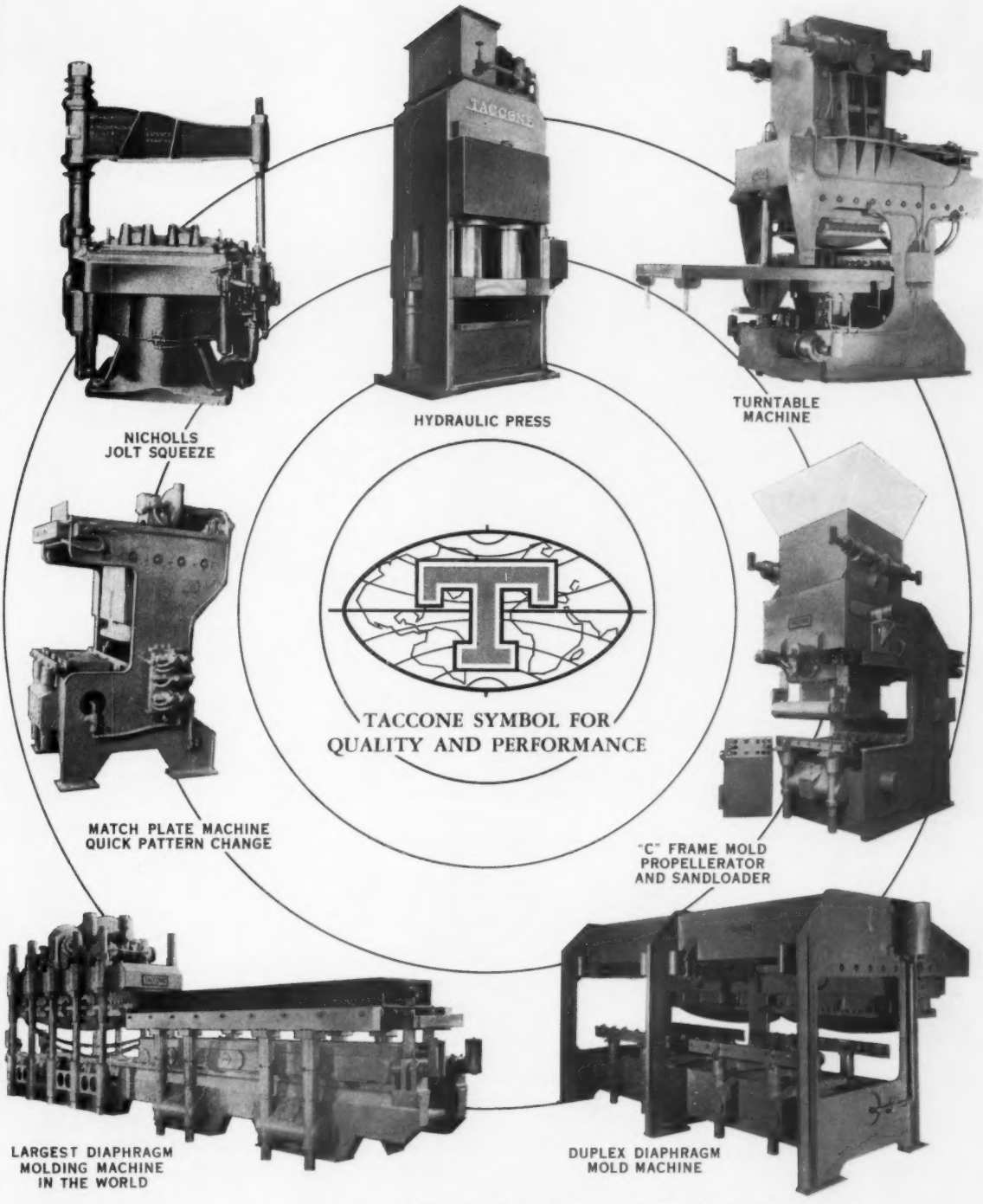

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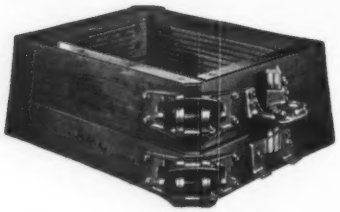

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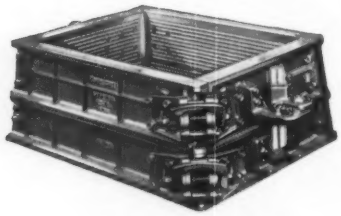

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WILLIAM H. SCOTT
. . . N. Y. district sales mgr.

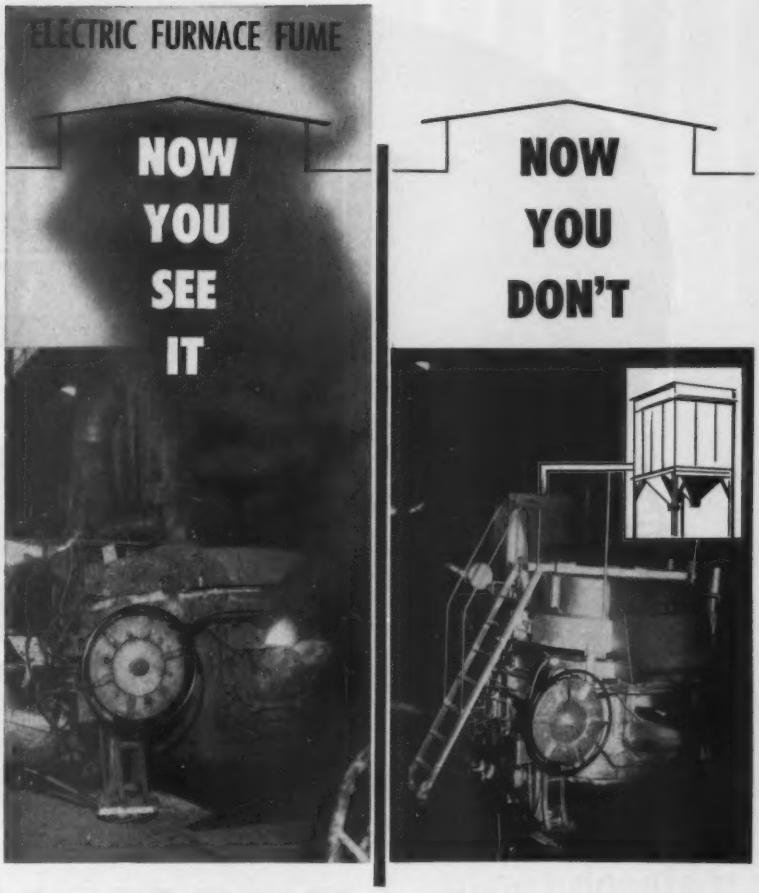
loys Co., Dearborn, Mich., Div. of Howe Sound Co. He succeeds **William James,** who has joined Centrifugal Casting Co., Long Beach, Calif. Mr. Grott continues as manufacturing manager. **John Fritz,** materials manager, assumes additional duties as assistant manufacturing manager. **George Haley** has been made supervisor of quality control.

William H. Scott, assistant district manager, has been named New York district sales manager, Eastern Gas & Fuel Associates, Pittsburgh, succeeding **W. J. Duncan,** who has retired. Mr. Scott will direct sales in New York city, parts of New York and New Jersey.

John W. Eder Jr., assistant sales manager, has been appointed general sales manager, Chicago Eye Shield Co., Chicago.

Edward W. Sacoff has been appointed manager of Link-Belt Co.'s Moline, Ill., district sales office, suc-

EDWARD W. SACOFF
. . . district sales mgr.



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A. KEMP STEVENS
. . . district sales mgr.

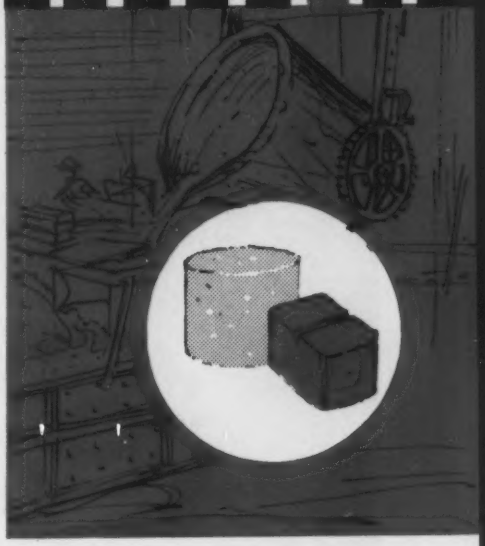
ceeding the late J. Charles Bullock. With the company 25 years, Mr. Sacoff was recently a district sales engineer in the Chicago area.

A. Kemp Stevens has been named head of the new district sales office opened recently by Wellman Bronze & Aluminum Co., Cleveland, at 967 Farmington Ave., Hartford, Conn., which will service the New England-Long Island area. **William F. Trakat Jr.** has been appointed regional sales manager for the eastern area, with headquarters at the new office at Cow Path Rd., M. R. No. 1, Lansdale, Pa.

Donald Alford has been appointed office manager, Eastern Malleable Iron Co., Wilmington, Del. **Vincent Neville** was named purchasing agent.

Robert M. Palmer has been appointed over-all field sales manager for the furnace and oven divisions, Hevi-Duty Electric Co., Div. of

WILLIAM F. TRAKAT JR.
. . . regional sales mgr.



alloy briquets for the cupola charge

Each different Ohio Ferro-Alloys briquet for the iron foundry has a distinct shape and color. Costly errors in adding silicon, manganese or chromium to the charge are avoided.

Silicon briquets are GRAY and **cylindrical** in two sizes: either 1 pound or 2 pounds of contained silicon. The 2-pound size is also available in a brick shape. Manganese briquets (shown above) are RED and are **oblong** in shape. Silicomanganese is YELLOW and **square.** Chromium briquets are GREEN and **hexagonal** in shape.

For detailed information, write for **Ferro-Alloy Briquets for The Iron Foundry.** It's free, and there's no obligation.

Ohio Ferro-Alloys Corporation
Canton, Ohio

Circle 663 on Page 39→

Tons of Castings Cascaded like Niagara Falls

Photo Courtesy of Lancaster Malleable Castings Co. Lancaster, Pa.

by AJAX® Lo-Veyor

IT'S PART OF THE SYSTEM for speeding up the flow of malleable castings from process-to-process.

This AJAX Lo-Veyor is designed into and built into this high production cost-cutting line to integrate production with material handling.

Lo-Veyor is driven by fully enclosed AJAX reciprocating drive and provides a self-contained rugged unit handling high tonnages with minimum maintenance. It is another example of adaptability of AJAX Lo-Veyors, Screens and other vibrating equipment for economical plant operation.

The broad experience of AJAX vibration engineers and field representatives may be helpful to you in uncovering important and often unexpected savings in conveying, screening, sorting, washing, drying, aligning and other multi-purpose operations.

An outline of your problems will receive expert attention...write today for 16 page AJAX Selection Guide No. 66.

AJAX/Conveyor Div.

AJAX Flexible Coupling Co. Inc.

204 Portage Road **Westfield, N. Y.**

PETER E. BARRY
. . . becomes sales director

Basic Products Corp., Milwaukee, with headquarters in Watertown, Wis. **John C. Lavey** succeeds Mr. Palmer as district manager of the eastern sales office in Little Ferry, N. J. **E. H. Andrus** has been named field service manager and **Norman McDonald** sales specialist.

Peter E. Barry, formerly sales engineer in the Wisconsin area, Thiem Products Inc., Milwaukee, has been appointed director of sales for the company's domestic and foreign divisions.

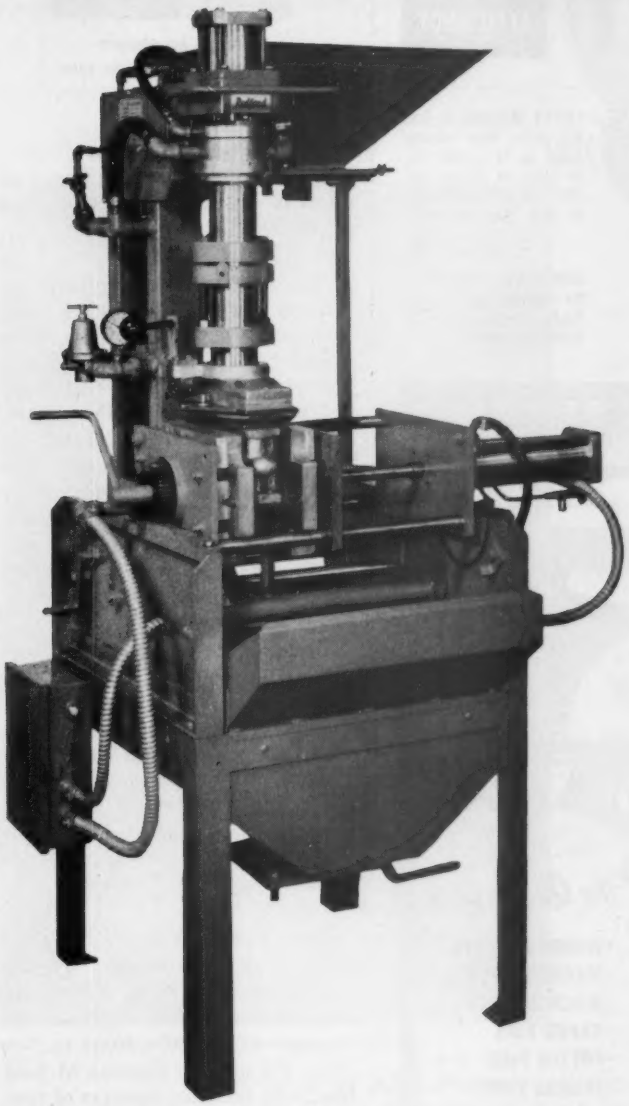
Robert F. Cox, formerly with Cummins Engine Co., Columbus, Ind., has joined Pangborn Corp., as sales engineer in the Hagerstown, Md., and Baltimore districts.

David W. Wallace has been elected president, Chicago Railway Equipment Co., Chicago, succeeding **Samuel J. Walker,** who continues as board chairman. **Donald E. Barton** was named vice president

ROBERT F. COX
. . . joins Pangborn Corp.

Redford

MODEL HP-4
SHELL CORE BLOWER



A very fast low cost machine that is setting new standards in the production of small shell cores. The quality of intricate shell cores is improved because sand is blown into core box cavities through unrestricted blow holes. A novel cradle-type core box clamp is used to invert the core box and at the same time bring the core box within easy reach of the operator for core removal. There is no out of balance weight to struggle with. The machine can handle core boxes up to 10″ x 10″ in size. Shell cores may weigh up to 4 lbs., before draining.

The HP-4 Redford has ample blow capacity and can also be used to blow Furfural resin sand mixes into heated core boxes.

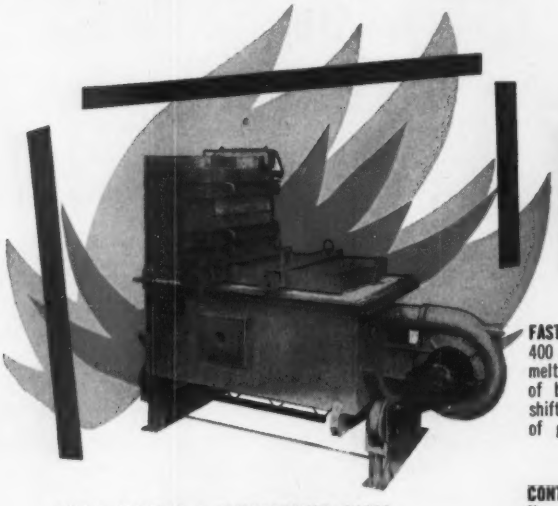
Price F.O.B. Detroit—$1,200.00
For complete information write for Bulletin HP-4

. . Above cores illustrate the variety of work that can be done with the Redford HP-4 Core Blower.

REDFORD IRON & EQUIPMENT CO.
20733 Glendale - Detroit 23, Mich.
Phone: KEnwood 1-8611

SAVE $ WITH REDA FURNACES

FUEL SAVINGS UP TO 50% REPORTED
USING REDA GAS-OIL FIRED FURNACES!



BEST HEAT EFFICIENCY

FASTER MELTING — One 400 series Reda Furnace melts up to 11,000 lbs. of brass or bronze per shift, and up to 6,000 lbs. of gray iron per shift.

CONTINUOUS POURING — No waiting until floors, flasks, boards, etc. are filled with molds!

LOWER MELTING & MAINTENANCE COSTS — One man can operate a Reda Furnace . . . No daily repairs needed!

FURNACE DIVISION WRITE TODAY FOR DESCRIPTIVE BULLETIN
REDA PUMP COMPANY - BARTLESVILLE, OKLAHOMA

Circle 651 on Page 39

CHILL KOOLHEAD NAILS

Chill Nails and Spiders

You can rely on "KOOLHEAD" and "STANHO" products

for... ACCURATELY CONTROLLED FOUNDRY CHILLING

Write for samples and prices

Choose any style from Jumbo to Stubby; slim, medium or horse nail blade; blunt, pointed, straight or 90° bent. There's a type and size Koolhead Chill Nail or Spider Chill to do your specific chill job best.

STEEL Stanho PRODUCTS

the Quality Line

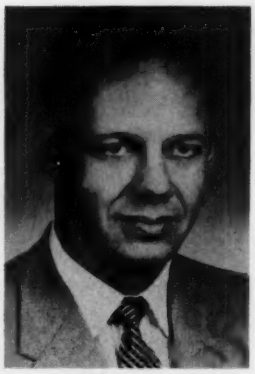
- WOODRUFF KEYS
- MACHINE KEYS
- MACHINE RACK
- TAPER PINS
- COTTER PINS
- SPECIAL PARTS

and other Stanho products Bulk or Packaged

WRITE for CATALOG and PRICES

STANDARD HORSE NAIL CORP
Since 1872 NEW BRIGHTON, PA

Circle 652 on Page 39



JAMES M. BROWN
. . . electrode products sales

of the railroad equipment division. **Albert E. Salatka** becomes vice president of Marion Malleable Iron Works Div., Marion, Ind.

James M. Brown has been appointed electrode products sales representative in Cincinnati, National Carbon Co., Div. of Union Carbide Corp., New York, succeeding **Rolf Lindenhayn Jr.**, who has been transferred to San Francisco as western division manager of brush and railroad products. Mr. Brown was a chemical products equipment sales representative in Chicago for the company.

Edward C. Hoenicke has been named president of Caribbean Fabricators Inc., Fort Lauderdale, Fla., a metal fabricating and contracting firm. He replaces **Ellis Colton**, who organized the company in 1958. Mr. Hoenicke was formerly general manager, Foundry Div., Eaton Mfg. Co., Vassar, Mich., and is a registered industrial consultant.

Arley J. Ball, formerly Cleveland district sales manager, Hewitt-Robins Inc., Stamford, Conn., has been named eastern regional sales manager with headquarters in New York. He succeeds **Norman M. Godfrey**, who becomes manager of operations of the company's Robins Conveyors Div.

R. H. Hancock Jr. has been named district manager of the Salt Lake City, Utah, and Denver territories for industrial and mining division products of Jeffrey Mfg. Co., Columbus, Ohio. He was vice president of

CUPOLA-CONTROLLED FOR INCREASING YOUR . . . . . FOUNDRY PROFITS

with ABC FOUNDRY COKE

ABC's 27" I.D. test cupola in operation.

YOU CAN:

- **Use a cheaper ingoing metal charge**
- **Improve coke to metal melting ratios**
- **Reduce "sick cupola" shutdowns and excessive coke boosters**
- **Maintain consistent carbons and temperatures**

Only ABC Foundry Coke is cupola-controlled—pre-checked in a production-size cupola for carbon absorption and melting temperature. These regular tests supplement physical and chemical analyses. Quality variations that show up only in cupola operation are detected quickly and are corrected before variations occur at your foundry.

Many foundries find that ABC test cupola results correlate with their own, enabling them to plan cupola operations more precisely. Results are available to ABC customers on request.

ABC's test cupola is also a research tool for developing new cokes according to need and improving the quality of existing types for your benefit.

A trial of ABC Foundry Coke will prove to you the superior performance that leads to greater profit.

ALABAMA BY-PRODUCTS CORPORATION

General Sales Offices:
First National Building
Birmingham, Alabama

Sales Agents:
Great Lakes Foundry Sand Company, Detroit; St. Louis Coke & Foundry Supply Co., St. Louis; The Ranson and Orr Company, Cincinnati; Kerchner, Marshall and Company, Pittsburgh; Balfour, Guthrie & Company, Ltd., San Francisco; Anselman Foundry Services, St. Charles, Illinois

Over five years service in foundry sand...JOY Limberoller® idlers require no maintenance

At this large automotive foundry conventional steel idlers were a constant source of trouble. Spilled foundry sand would work its way into bearings and stop the idler rolls from turning. The result was torn conveyor belting and costly downtime.

After a trial installation, this foundry standardized on Joy Limberoller belt conveyor idlers throughout the plant. The frozen idler problem was completely eliminated, as well as the need for frequent inspection.

The Limberoller idler works so well because it has just two bearings instead of six. These are mounted at both ends of a flexible wire rope, to which neoprene discs are molded. The bearings are up out of the sand, unaffected by spillage. Fouled bearings are never a problem, and maintenance costs go down to almost nothing. Join the foundry men who have ended their sand conveyor problems by replacing steel idlers with Joy Limberollers. Conversion is quick and easy. We'll be glad to give you all the details . . . write for bulletin 2747-13.

JOY

Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario

Circle 658 on Page 39

Equipment Engineering Co., Sandy, Utah, a Jeffrey manufacturer's representative, and will continue his district office there.

Arthur G. Witt, since 1958 central area sales manager, has been named general sales manager of the Cleveland Div. of Precision Castings Co., Div. of Precasco Corp., a part of Fulton Industries Inc., Atlanta.

Harold H. Burrows, senior vice president of rubber sales, Manhattan Rubber Div., Raybestos-Manhattan Inc., Passaic, N. J., has retired after 45 years with the company.

J. M. Crawford has been made assistant manager, Independent Foundry Supply Co., Los Angeles. **A. B. Lamb** has been named sales manager. **Lamar Jones** recently joined the company as sales engineer.

Leonard J. Novak, formerly with Dalton Foundries Inc., Warsaw, Ind., has joined Ohio Ferro-Alloys Corp., Canton, Ohio, as sales representative in western Indiana and eastern Illinois.

Harry Martin, since 1934 sales manager of the Detroit division, E. F. Houghton & Co., Philadelphia, has retired after 31 years with the company. **James H. Richards,** who has represented the company in Davenport, Iowa, succeeds Mr. Martin in Detroit.

Grace M. Belville has been named president of Belville Mfg. Co., Shelley, Idaho, succeeding the late Russell A. Belville, its founder. **Kit Ballard** was named general manager and a director.

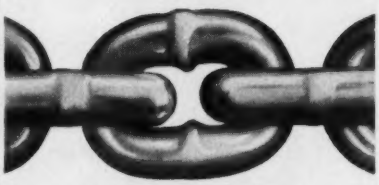
Offers Six-Part Safety Course

The National Safety Council is offering a course which consists of six text booklets entitled "Men and Motives in Safety Supervision" and a manual for the discussion group leaders. Each booklet is a one-hour training session for foremen and tells how to set up meetings and apply the material to individual plant situations. Further information is available from the council at 425 N. Michigan Ave., Chicago 11, Ill.

VALUED FOR

Depend-ability

TM alloy slings



TM Alloy Slings have a reputation for dependability . . . brute strength and low overall costs. Factory-made. Certificate of Test furnished. Bulletin 14A contains all data. Call your distributor, steel warehouse, hardware wholesaler or write—

S. G. TAYLOR CHAIN CO., Inc.
Plants: Hammond, Indiana
3505 Smallman St., Pittsburgh, Pa.

Prompt repairs on alloy slings in both plants.

Taylor Made CHAIN SINCE 1873

Circle 659 on Page 39

WHAT'S HAPPENED TO INDUCTION MELTING IN THE LAST SEVEN YEARS?

It's a little like the old days all over again! Induction melting passed twenty-five years without change. Then Inductotherm decided to bring induction melting up to date. Since that day, seven years ago, there've been some changes made.

To the basic advantages of induction melting—speed, cleanliness, magnetic stirring—Inductotherm has added easy installation, easy operation, and easy care.

For example, Inducto® initiated power feed through the trunions in their tilting furnaces—thus reducing lead length, cutting power loss, simplifying pit construction. Small furnace design is also ingenious. Even the smallest hand held furnaces have "plug-in" mercury type fittings for fast and effective power disconnect during a pour.

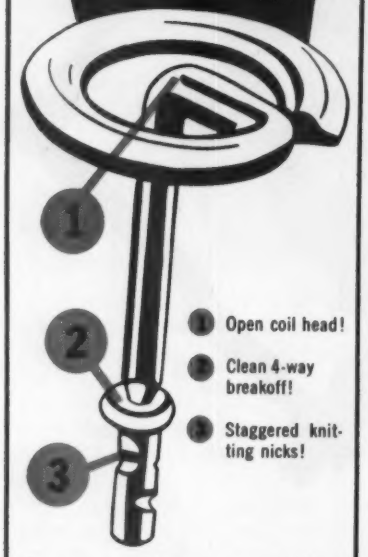
Why do business with Inductotherm?

The biggest innovation in induction melting has been the Inductotherm concept of service. Not just fast repairs and overnight replacement of parts (even M-G sets) . . . but a basic concept of "why we're in business." *Inductotherm is out to fit induction melting to your needs.* We will make every effort to improve our equipment and the induction technique, never asking you to trim your needs to the limitations of our equipment.

If you'd like more information on Inductotherm furnaces, write for Bulletin 70. But, for a taste of Inductotherm service, ask to have an engineer call. Inductotherm Corporation, 412 Illinois Ave., Delanco, New Jersey.

INDUCTOTHERM

these CLEVELAND CHAPLET features



1 Open coil head!
2 Clean 4-way breakoff!
3 Staggered knitting nicks!

keep casting quality HIGH!
improve production and SAVE MONEY!

These sturdy open coil head chaplets make precision casting easier because they pack firmer . . . hold core position.

They leave no voids . . . and finally, they break off cleaner. What's more, they cost no more than ordinary plate heads.

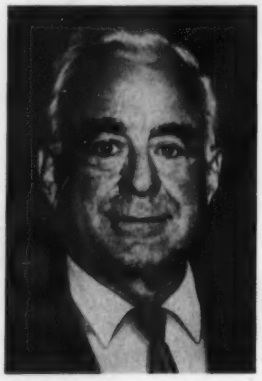
Handy chaplet guide! Ask for new Chaplet Catalog Today.

THE Cleveland CHAPLET & MFG. CO.
26470 Lakeland Blvd. • Cleveland 32, Ohio

Circle 664 on Page 39

OBITUARY

James W. Tiscornia, 75, co-founder, president, and general manager of Auto Specialties Mfg. Co., St. Joseph, Mich., died Dec. 16. Founded in 1909 to produce small automotive parts, the company was situated successively in California, Chicago, Joliet, Ill., and St. Joseph, where heavier castings and automobile jacks were produced. Mr. Tiscornia expanded the company from a small one-plant operation into four plants, with factories in St. Joseph, Benton Harbor, and Hartford, Mich., and Windsor, Ont.



JAMES W. TISCORNIA

W. Henry Cantelon, president, Auto Specialties Mfg. Co. (Canada) Ltd., Windsor, Ont., died recently. The company is a division of Auto Specialties Mfg. Co., St. Joseph, Mich.

Daniel L. LeMarche, 65, president of American Malleable Castings Co., and secretary of Arro Expansion Bolt Co., both of Marion, Ohio, died Dec. 27.

Daniel G. Slee, 67, president and treasurer, Alloy Founders Inc., Toledo, Ohio, died Nov. 3.

Roy C. Patterson, vice president, Geneva Metal Wheel Co., Geneva, Ohio, died Dec. 15.

Thomas J. Donnelly, 88, a leader in the Pattern Makers Association of Cleveland, and one of its two organizers, died Dec. 17, at his home there. For many years he was a business agent for the association. A patternmaker for over 50 years, Mr. Donnelly was with the Oster Mfg. Co., Cleveland, at the time of his retirement.

Arnold J. Salg Sr., 70, active in the foundry industry for 54 years until his retirement in 1958, died Dec. 12. He served as foundry superintendent at Spooks Iron Works, E. St. Louis, Ill., Fulton Iron Works, St. Louis, Motors Castings Co., Detroit, Stearns-Roger Mfg. Co., Denver, Gisholt Machine Co., Madison, Wis., Stainless & Steel Foundry Div., Minneapolis and St. Paul, and Shakopee Foundry Co., Shakopee, Minn.

James Eastwood Jr., 47, president, Benjamin Eastwood Co., Paterson, N. J., died Dec. 22, in Englewood, N. J. He succeeded his father as president of the family-owned business in 1946.

Walter Giele, a foundry consultant specializing in foundry plants and equipment for many years, died Dec. 23. Mr. Giele was chairman of the Philadelphia Chapter of the American Foundrymen's Society in 1956-57.

J. Scott Wardle, former president of Mobile Pulley & Machine Works, Mobile, Ala., died Dec. 23. Mr. Wardle had served as a director of Steel Founders' Society of America.

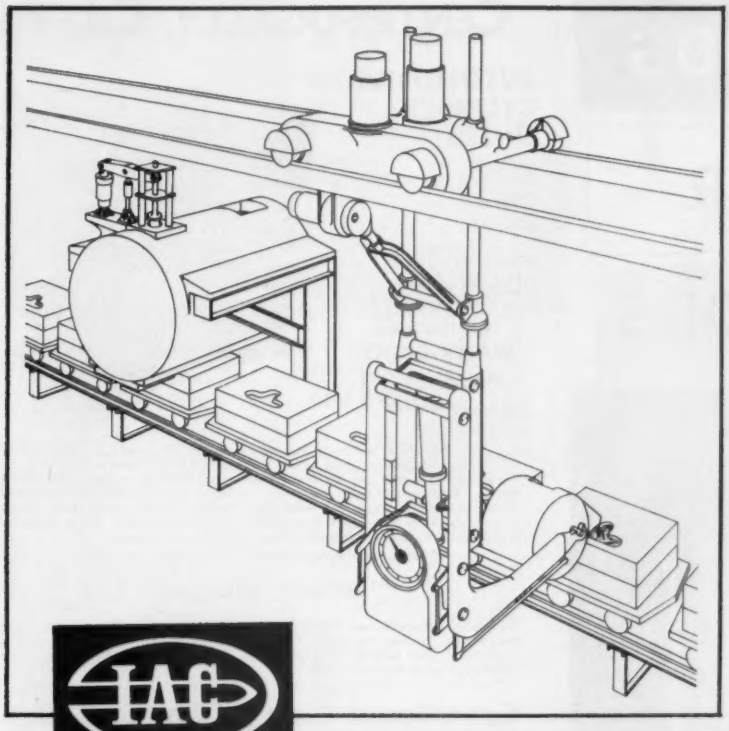
Harry S. Bradley, 85, founder and president, Penn-Mold & Mfg. Co., Dover, Ohio, and former president, Shenango-Penn Mold Co., Dover, died Jan. 8.

Martin T. Manion, executive vice president, Centre Foundry & Machine Co., Wheeling, W. Va., died Dec. 15.

E. C. McDonald, director of personnel for Treadwell Engineering Co., Easton, Pa., died Dec. 18.

Gilbert B. Richards, president of O P W Corp., Cincinnati, died Dec. 10.

Calbraith P. Champlin, president and treasurer, Strong Steel Foundry Co., Buffalo, died Dec. 7.



this fully automated pouring device

Saves manpower and metal

Improves casting yield

Reduces scrap losses

Assures perfect pouring rate control

Eliminates the "human element"

IAC

PRESENTS THE FULLY AUTOMATIC POURING DEVICE

(Patents Pending)

POURMATIC

The POURMATIC has been developed specifically for the high production foundry. Successfully tested for 3 years in a modern automated malleable iron foundry, it provides the latest advancement in foundry automation and pouring technology. You will be interested in the substantial savings which this automatic pouring method can bring to your operation. Write today for further details.

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Fill out, tear out, and mail this coupon today

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Gentlemen:
Please send me further information on the I.A.C. POURMATIC

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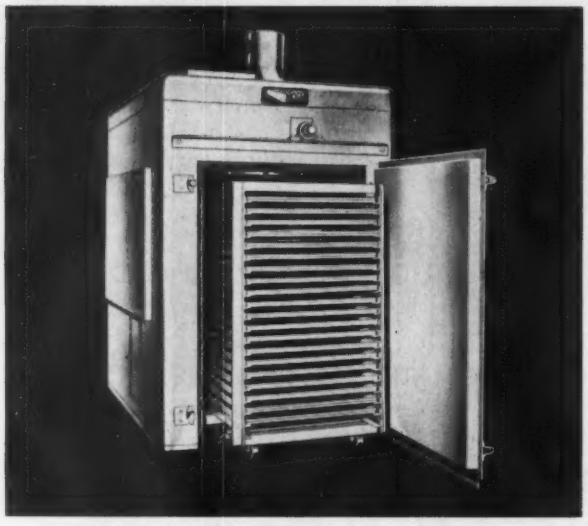
Circle 665 on Page 39

NEW TRENDS

CALL FOR

NEW METHODS



MOCO Ovens Keep Pace With Forward-Looking Foundries

Increased output at lower cost per unit is the result when you specify industrial ovens *custom-engineered* for your application. That's why Michigan Oven Company heat treating equipment is best for aluminum alloy processing. MOCO-engineered ovens are backed by years of technical research to insure maximum heat processing efficiency.

Michigan Oven Company is well-known for its engineering and craftsmanship in building ovens to fit the specific needs of manufacturers in the foundry industry.

Naturally, you won't want to miss any *sound* ideas on a better way to process your product. MOCO engineering has many of them. Wouldn't it be wise to investigate?

WRITE TODAY FOR FREE INFORMATION

This MOCO technical literature points the way to many cost saving ideas. Send for it today without obligation.

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MOCO

415 BRAINARD
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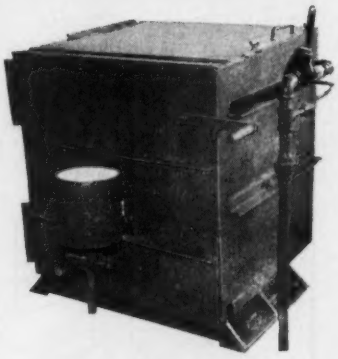
CENTRIFUGALLY CAST

AUTOMOBILE CYLINDER LINERS

DIESEL ENGINE LINERS

BRONZE BUSHINGS

on the new
WATER-COOLED
Model M-WC
(Illustrated)



Utilizes low cost permanent molds of available steel tubing to produce gray machinable cast iron or bronze bushings. Water cooled molds can be maintained at either high or low temperature easily. High or limited production in very small space with unskilled labor. Completely safe for workmen. Simple, sturdy equipment. Quick changeover from one mold to another. Practically 100% metal yield of high quality, denser castings. Metal porosity eliminated.

Write for New Bulletin #257 Illustrating Model M-WC

RESEARCH FACILITIES

We have available an Experimental Foundry equipped for ferrous and non-ferrous melting for both vertical and horizontal centrifugal casting production. Our facilities are available to foundries for research or trial centrifugal castings at low cost.

Centrifugal Casting Machine Co.

P. O. Box 947 Tulsa 1, Okla.

Circle 667 on Page 39

Complete facilities to produce all types of welded constructions . . . carbon or stainless steel and aluminum from 1/16″ to 4″ thick . . . to your specifications.

This includes tanks, chutes, hoppers, machine bases, stacks, breechings, angle rings, special cars, buckets, and other equipment.

Call or write for estimate. Let us show you how we can save you time and money.

PENN IRON WORKS, INC.
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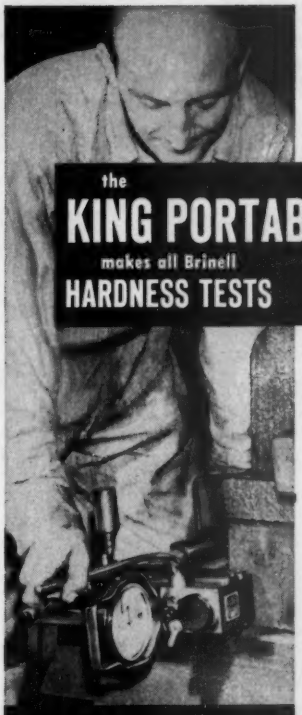
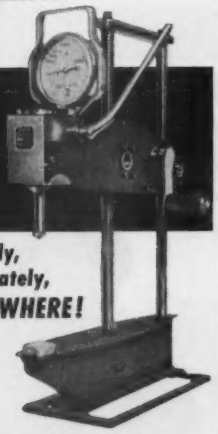
Circle 668 on Page 39



any size, shape or thickness..

the **KING PORTABLE** makes all Brinell **HARDNESS TESTS**



quickly, accurately, ANYWHERE!

Round, flat or unusual shapes or sizes are no problem to test with the King Portable. Rugged—lightweight, it tests metals from softest leads to toughest alloys having over 700 BHN. And it can be used anywhere, accurately!

Write for complete information and specifications.

KING TESTER CORP.

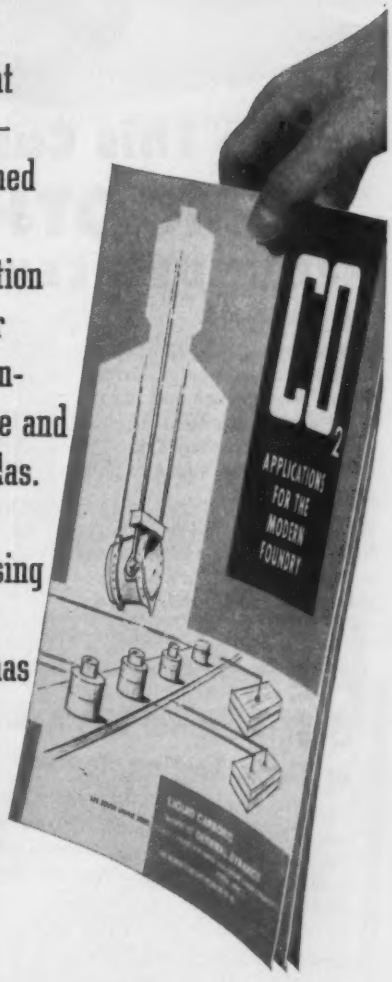
448 North 13th St.
Philadelphia 23, Pa.

Certain areas open for representatives

Circle 669 on Page 39

FREE!

It's only eight pages long— But it's jammed with vital information about CO_2 for foundries. Contains new core and binder formulas. Illustrates complete gassing kits. First time anyone has ever offered such a complete manual. Send for yours today.



LIQUID CARBONIC
DIVISION OF **GENERAL DYNAMICS**

In Canada: Liquid Carbonic Canadian Corporation, Ltd., 8375 Mayrand Street, Montreal 9, Quebec

LIQUID CARBONIC
Division of General Dynamics Corporation
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Please send me your new, free booklet "CO_2 Applications for the Modern Foundry."

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MURPHY PISTOL SPRAYER guaranteed

2922

Forces blackening into pores and pockets of molds. Sprays silica wash, oil, or water equally well. Used also to sand blast, to clean automobile and diesel engines, to spray centrifugal molds. Standard of the foundry field for more than 50 years. Priced from $17.25. Write for quantity discounts.

(Also furnished in a deluxe model with air pressure reducing valve, 20' of air hose, and 5' of suction hose, both of superior quality, oil and acid resisting plastic.)

Ask your foundry supply dealer or —

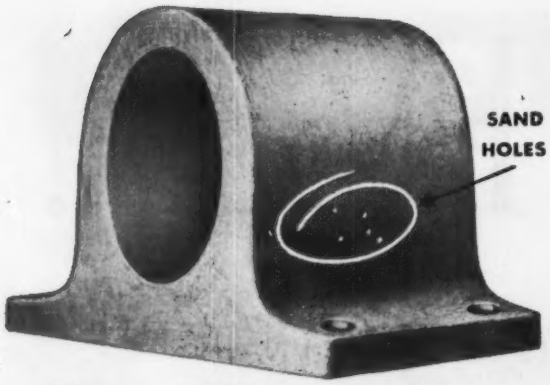
Write for FREE Data Sheet No. 2922

JAMCO

JAS. A. MURPHY & CO., INC.
1425 EAST HIGH STREET, HAMILTON, OHIO

Circle 670 on Page 39

Circle 671 on Page 39



Save This Casting *with* SMOOTH-ON FOUNDRY CEMENTS

Often a perfectly good casting has blow or sand holes, surface blemishes, or rough and porous areas that detract from its appearance. But there's no reason why it can't *look* as good as it really is.

Simply use Smooth-On Foundry Cement. It goes on easily, quickly . . . hardens rapidly at a predictable rate . . . stays firmly in place.

SHADINGS TO MATCH ANY CASTING

4A - Medium Gray
4AA - Light Gray
4B - Dark Gray

Quality Control That Assures You of Tight, Lasting Repairs

Every lot of Smooth-On Foundry Cement is laboratory tested for setting time, hardness and color. You can be sure of tight, lasting, good looking results every time, provided the directions are followed.

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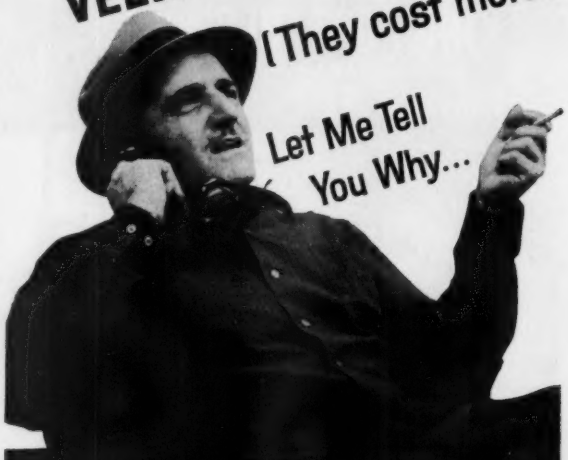

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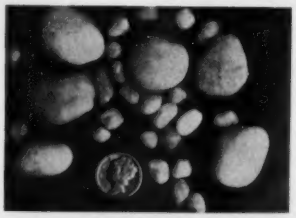

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for Brass or Bronze Melting
gas or oil fuel operated.

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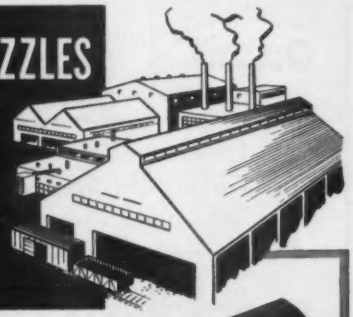
to improve general foundry operations *and increase* product quality



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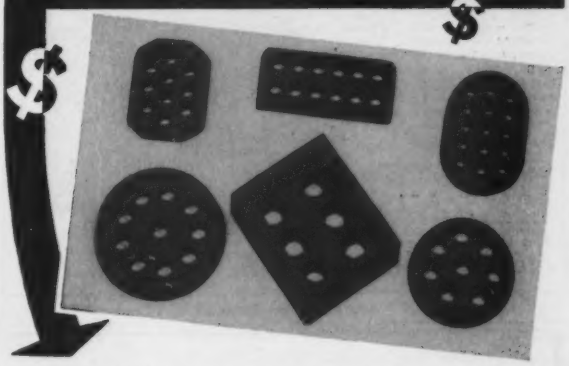

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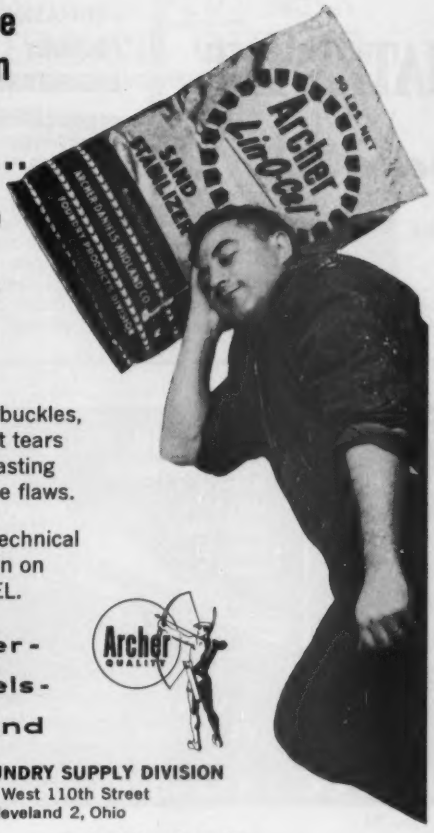
Just The Cushion You Need...

(Between Sand Grains)



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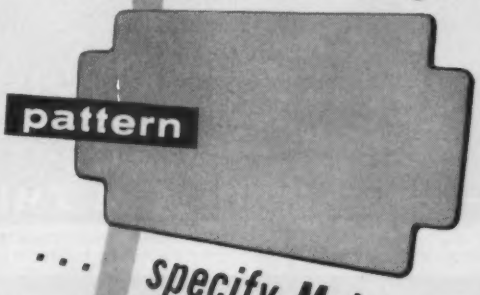
... that stay flat

... and last longer



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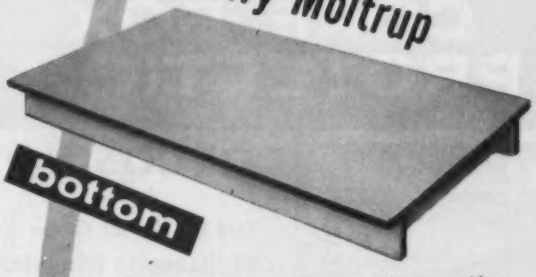

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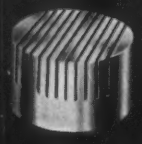
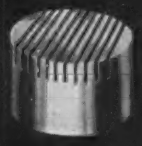
SLOTTED CORE BOX VENTS



X-TRA DEEP HEAD .156 Wide Slots .014

SHALLOW HEAD .031 Wide or Narrow Slots .014 .010



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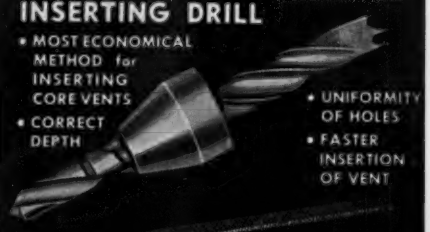

- UNIFORMITY OF HOLES
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- FOR CLEANING SLOTS
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- EASY TO USE

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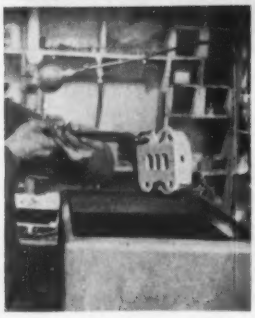
CORE BOX PROTECTION



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By A. J. Murphy

Covers the general principles unifying foundry techniques of all industrial nonferrous metals in relation to metals in the liquid state to the process of solidification and to the factors influencing properties of casting. Other materials include the part played by gas dissolved in liquid metals, its control and its influence on cast products, factors influencing the grain size of castings, and mechanical properties of castings as complete components compared with the properties in conventional test samples.

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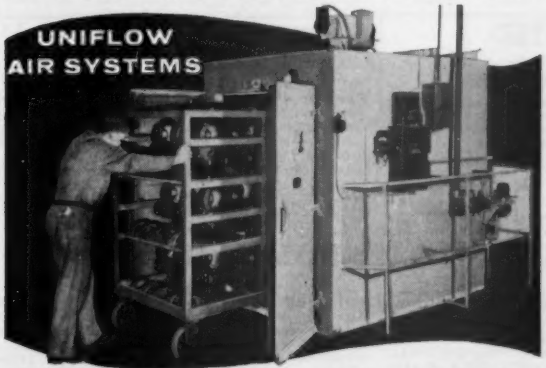

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DESPATCH OVEN CO.

DESPATCH OVEN CO. 619 S.E. 8th St., Minneapolis 14, Minn.

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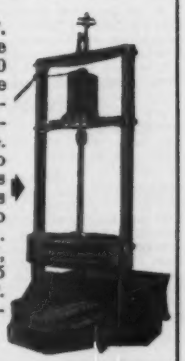

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ADDRESS

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Circle 692 on Page 39

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FOUNDRY FOREMAN

To assist foundry superintendent in managing foundry operations; 100 employees producing squeezer machine small gray iron, some floor work and various alloy castings, all of electric arc melt. This position is permanent with opportunity of promotion to foundry superintendent in near future. Must be experienced in gray iron molding and have metallurgical degree or equivalent training.

A progressive manufacturing company with captive foundry located in Maryland. Salary open depending on experience. Fringe benefits above average, with noncontributory surgical, hospitalization and profit sharing program. Submit complete resume and desired salary.

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for a resourceful, aggressive iron foundryman capable of progressively improving pattern equipment and operations in a captive manufacturing-jobbing foundry located in an attractive town in Hudson River Valley, New York. Must have management skill such that he can ultimately assume complete charge of all operations and management. Good labor conditions exist but need intelligent leadership and some sales ability. This can be a life-time career. Resume with salary requirements required in your response.

Box 761, FOUNDRY
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To work on development and research projects in investment casting foundry. Applicant should have experience in this field and educational background of chemistry and/or metallurgy. Send application with complete resume.

CASTING ENGINEERS
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To take charge of coreroom and squeezer operation in Midwestern steel foundry.

Must know sand and be able to maintain good production.

Average number of employees to be supervised about 30.

If interested, send experience, education and qualifications.

BOX 730, FOUNDRY
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• HELP WANTED

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Experienced shot and grit service man. Contact foundries, steel mills, metalworking plants. Salary and commission.

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Highest caliber individual for very responsible position with exceptional growth potential, to supervise molding, pouring, coreroom, and shakeout; experience in corrosion resisting steel desirable. Address: Box 744, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

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$7,200 TO $8,400

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COREROOM FOREMAN ASSISTANT

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• POSITIONS WANTED

FOUNDRY FOREMAN OR TIME STUDY MAN

Age 26; 5 years' experience in all phases of alloy foundry operations; have built cleaning room standard data using Stewart Instrument Co. Workometers; cost estimating; supervisory experience in cleaning and molding. Address: Box 776, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

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Thoroughly experienced in design and application of Coreroom machinery, desires connection with progressive manufacturer for development of new jobbing foundry core machine unit. Address: Box 777, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

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Experienced foundryman with floor, machine molding, and core room supervisory experience. Stainless steel and iron. Green or dry sand molding. Versed in gating, risering, CO_2 core making and production procedure. Address: Box 773, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

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26 years' experience producing light to extra heavy jobbing and production iron, ductile, brass, steel and aluminum castings. 20 years' supervisory experience. Metallurgical and sales background. Age 48. Now employed. Address: Box 751, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

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Graduate foundryman with diversified experience in gray iron foundry operations, progressive, resourceful, cost and quality minded, now employed, wishes a challenging post with a production shop planning to improve operations and expand. Address: Box 736, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MANAGER-SUPERINTENDENT

Practical gray iron foundryman, thirty years' broad experience producing quality castings. Technically trained, modern methods with good record of low costs and scrap. Experience covers jobbing and highly mechanized production. Connection desired with sound reliable firm needing high grade foundryman for results. Address: Box 752, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

GRAY IRON FOUNDRYMAN

With proven record would like to make change. Now employed. Will relocate. Address: Box 755, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• POSITIONS WANTED

PERMANENT MOLD ENGINEER

Experienced in all phases of mold design and operation. Graduate engineer with broad nonferrous background. Address: Box 766, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MOLDING FOREMAN

Twenty years' EXPERIENCE in steel foundry. Floor molding and machine molding; Bumpers or slingers. All types castings to 20 tons. Address: Box 745, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

ATTENTION!

If you are looking for an additional gray iron product to add to your operation to help outride your overhead and have capital to build inventory, I can furnish you Pattern Equipment. Desire position with company and percentage on sale of product under contract. Prefer an Ohio Location. Cored work. $200,000 yearly sales. Address: Box 758, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

PERMANENT MOLD DESIGNER

Fully experienced in Aluminum and Magnesium mold design and operation. Available in New York City and New England area. Address: Box 734, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOREMAN

Twenty-one years' steel foundry experience, recently as molding foreman (5½ years)—foundry ceased operation. Full resume available. Age 52. Will relocate. Address: Box 757, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRYMAN

Experienced in gray iron and nonferrous metals, mechanization, design, patternmaking, gating, risering, costs. Presently employed as pattern supervisor. Address: Box 748, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY SUPERVISOR

Experienced in all departments of foundry, 20 years as supervisor, from foundry foreman to general superintendent. Prefer malleable job shop, will relocate. Address: Box 756, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT

Technically, practically and administratively experienced in producing grey iron, ductile, malleable and steel. Presently employed. Will consider overseas assignment. Address: Box 762, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT OR MANAGER

Practical foundryman, nationally known for a job well done. Age 48. Good health. Now employed. Looking for more action ferrous or nonferrous, $15,000 minimum. Address: Box 759, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERVISOR—METALLURGIST

Young graduate metallurgist, experienced in gray iron and steel casting foundry practice, development, and supervision, seeks new position with opportunity. Address: Box 770, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MELTING FOREMAN—MELTER

Steel foundry, electric arc furnaces, basic or acid practice. Carbon, alloy and stainless steels. Capable of taking full charge, including budget and incentive systems. Address: Box 754, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FERROUS, NONFERROUS FOUNDRYMAN

Twenty-six years' practical and technical experience in jobbing and production foundries in Europe and U. S. A. 14 years' supervision and troubleshooting. Age 43. Prefer nonferrous. Resume on request. Address: Box 767, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

METALLURGIST

Broad acid and basic cupola melting experience, quality control of metal castings and sands. Age 49. Chicago or 50 mile radius preferred. Address: Box 774, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• OPPORTUNITY

PARTNER WANTED

With experience in the pressure casting of match plates for now operating business in central Indiana. Address: Box 725, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• EMPLOYMENT SERVICE

FOUNDRY PERSONNEL SPECIALISTS

National Placement and Procurement of

GENERAL AND PLANT MANAGERS, PLANT SUPERINTENDENTS, FOREMEN—ALL DEPARTMENTS, METALLURGISTS, ENGINEERS, CONTROLLERS, ACCOUNTANTS, SALESMEN, SALES MANAGERS, PERSONNEL DIRECTORS, PURCHASING AGENTS

Confidential Inquiries Invited
From Employers and Qualified Applicants
For Fast Competent Assistance Contact

DRAKE PERSONNEL, INC. **FINANCIAL 6-8700**
JOHN COPE, DIRECTOR, 29 E. MADISON ST., CHICAGO 2, ILL.

• REPRESENTATIVES WANTED

MANUFACTURER'S REPRESENTATIVE WANTED

Well known Foundry Supply Manufacturer wants representation in portions of Indiana, Southern Michigan, Ohio. Excellent Opportunity. Write complete background, experience, etc. Address: Box 727, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MANUFACTURERS REPRESENTATIVE

To cover Gulf coast states for top producer of stainless steel, hi alloy and bronze centrifugal castings. In letter describe present lines and territory covered. Address: Box 731, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SALESMAN

Foundry equipment and supply salesman wanted by supply house for Illinois and Indiana area. Must have complete knowledge of line. Car furnished. Reply to Address: Box 728, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• FOUNDRY CONSULTANTS

FOUNDRY CONSULTANT—NONFERROUS

Sand casting—permanent mold casting—centrifugal castings—in aluminum, brasses, bronzes, 30% leaded bronze—aircraft quality bearings and castings. Address: ED JENKINS, West Palm Beach, Florida. PHONE: TEMPLE 2-8685

FOUNDRY CONSULTANT—FERROUS

Are you having scrap trouble, cupola, molding sand, cores . . . . . I can cure them. Address: G. C. (JACK) COLE, 1629 Roys Avenue, Elkhart, Indiana. Phone: Jackson 3-4393.

• FOUNDRIES WANTED

WANTED-TO-BUY

Operating gray iron jobbing foundry capacity eight to ten molders. Illinois or Wisconsin area. Address: Box 747, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY—WANTED—EQUIPMENT

Foundry investment organization needs used equipment to activate and mechanize a large foundry. Complete foundry with or without property will be considered. Please be specific as to price and when inspection can be made. Principals only. All replies confidential.

BOX 764, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

FOUNDRY WANTED

GROUP OF FOUNDRY ENGINEERS AND INDEPENDENT MANUFACTURERS WANTS TO PURCHASE FOUNDRIES (FERROUS AND NONFERROUS) WITH OR WITHOUT PROPERTY. PLEASE SUBMIT COMPLETE DETAILS AS TO CAPACITY, TYPE OF PRODUCTION, FOUNDRY EQUIPMENT, FLASK INVENTORY.

PRINCIPALS ONLY
ALL REPLIES CONFIDENTIAL

BOX 763, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

• WANTED-TO-BUY

WANTED

3 bronze melting furnaces, Walker-York, coke fired. 2 for No. 100 crucible. 1 tilting 500#. Will consider good oil fired. Also band saw, cutoff saw, small Wheelabrator or 4 ft. table blast. Steel flasks 12" x 16" or 12" x 18". State price. Address: Box 750, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• FOUNDRIES FOR SALE

SMALL GRAY IRON FOUNDRY

Modern equipment, nice home included and other extras. Plenty of land for expansion. Detroit, Michigan area low down payment. Opportunity for experienced foundryman. Address: Box 760, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOR SALE OR RENT

Iron foundry at Danville, Pennsylvania
30,000 sq. ft.—fully equipped
Ready to operate—orders on hand
Rent: $400.00 per month

DANVILLE FOUNDRY CORP.
DANVILLE, PA.

FOUNDRY FOR SALE

Fully equipped now operating gray iron foundry in Western New York State for sale. Due to illness and age present owners want to retire and settle an estate. Any reasonable offer considered.

BOX 765, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

• FOR SALE

FOUNDRY LIQUIDATION

Coleman #4 Junior Rolling Drawer Core Oven
Simpson Porto Muller
Simplicity Portable Screening & Aerating Unit 2' x 3' Model "C"
B & P Mulbaro #3½
Whiting 16" bottom radius x 54" long—"U" type mixing ladle
Cupola 60" diameter Shell
Ingersoll-Rand Blower Type FS-345, 3000 CFM—1# pressure
Bondactor Model #1250-S
Reda Melting Furnace—Series—1000
For complete listing of FLASKS, RAMMERS, LADLES & OTHER MISCELLANEOUS EQUIPMENT—WRITE:

THE COEUR D'ALENES COMPANY
BOX 969
WALLACE, IDAHO

FOR SALE

SIMPSON #2 UD Muller — "A-1" Condition Priced under present market value for fast moving.

BEARDSLEY & PIPER S/D GYRO screen 36" x 60" 70-T per hour on 1" screen w/motor, switch P/B starter. Like new. Never set up.

Model "L" SCREENARATORS (2) Rebuilt

SIMPSON #1 UD Muller w/motor, loader, aerator and all controls—Good as they come.

OSBORN #559 Jolt Pin Lift—in service less than ninety days.

All equipment guaranteed as represented

W. O. McMAHON
P. O. BOX 5799 HOMEWOOD STATION
BIRMINGHAM 9, ALABAMA
PHONES TREMONT 1-2088 AND 9-6170

FOR SALE

Moore Rapid Lectromelt Furnace type D ser. #203-200KVA transformer 4160V to 90V. Westinghouse controls. Melts 500# carbon alloy or stainless steel per hour. Good condition-operating daily. $7500.00 F.O.B. Belleville, New Jersey. Address: Box 772, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY EQUIPMENT

WHEELABRATORS

(1) 20" x 27" C/W Dust Collector
(2) 27" x 36" Rubber Belt C/W Dust Collector & S/H
(2) 27" x 36" Steel Flight C/W Dust Collector & S/H
(2) 36" x 42" Steel Flight C/W Dust Collector & S/H
(1) 48" x 72" Steel Flight C/W Dust Collector & S/H
(2) 1-A-Multi Tables W/8-19" Tables C/W/D/C
(1) Wheelabrator Skip Hoist—For 27" x 36" (Never Used)

SAND MULLERS

(1) Clearfield #404 4' 400# Cap.
(1) Clearfield #610 6' 1500# Cap.
(1) Beardsley & Piper 3½ Mulbaro
(1) Simpson—1—C—C/W/Skip Hoist. 4' 500# Cap.
(1) Simpson—#3 UD—8' 3000 # Cap.
(1) Nat'l Engineering Skip Loader for—Simpson Muller

CORE BLOWERS

(1) Demmler #55—Ser 2032 C/W Air Clamps
(1) Redford #4-D-Ser. 4-D-114-60—Coreshoot & Blow. C/W Air Clamps

MISC. FDRY. EQUIPMENT

(1) Model—"M" B/P Screenerator
(1) Stroman—Rev. Furnace—1957—Gas Fired C/W-Controls 600# Aluminum—1800# Brass—Automatic Tilt
(6) Ingersoll-Rand Air Hoist —500# to 10,000#
(6) Budgit Hoist 500#—2000#
(6) Master Bench Rammers 2-BA (Never Used)

Molding Machines — Core Ovens—Mold Dryers—Core Machines — Handy Sandys —Shake Outs—and Many other Items—Send us Your Requirements — List your surplus equipment with—

FOUNDRY ASSOCIATES

927 S. CICERO
CHICAGO 44, ILLINOIS

Circle 866 on Page 39

• FOR SALE

FOR SALE

3-Phase Arc Furnace, Moore Rapid Lectromelt, size T, 4000/2300 volt, 60-cycle, 500 lb./hr. capacity, with control panel, less transformer and transformer controls. Make offer to, or obtain further information from: LINDE COMPANY, Laboratory Works Engineering Department, 1500 Polco Street, Indianapolis 24, Indiana.

GOOD USED FOUNDRY EQUIPMENT

FOR SALE

OSBORN #3161 Roto-Lift
OSBORN #712PJ Jolt Squeeze Pin Lift
OSBORN #275J Jolt Squeezers
SPO #110PJ Jolt Squeezers
OSBORN #276J Jolt Squeezers
SPO #2114G Jolt Squeeze Pin Lift
J & J #918 Jolt Rollover
J & J #612RC Jolt Rollover
TABOR #22c Jolt Rollovers
SIMPSON #0 Style C
SIMPSON #1 Style UD w/Loader
SIMPSON #2 Style C
SIMPSON #2 Style UD
B & P Mulbaro
B & P #50A
CLEARFIELD #610
B & P #S, M, L Screenerators
Air Hoist—1000-10000 lbs.
Am. Wheelabrator Tumblast 27" x 36"
ROYER #NC4-pneumatic tires
B & P MOTIVE JR. SANDSLINGER

BUY—SELL—LIQUIDATE

PEK MACHINERY CO.

P. O. BOX 4148 BERGEN ST. STATION
JERSEY CITY 2, NEW JERSEY

FOR SALE

FOUNDRY GLOVES—Full gauntlet, 21" overall length, like new, mitten style, made from asbestos canvas, lined, 95 pair at $3.50 pr. Original government cost $15.00 pr. WELDERS GLOVES —All leather, lined, gauntlet, like new, 10 dozen at $25.00 dozen. Address: AMERICAN CANVAS CO., 210 Commercial Street, Boston, Massachusetts.

HARDWOOD FOUNDRY WEDGES

Standard and special sizes made from finest Oak and Hickory, packed in burlap bags. Reasonably priced. Address: Western Wheelbarrow Mfg. Company, (Established 1895) South Fort Smith, Arkansas.

FOR SALE

27" x 36" American Wheelabrator, Serial Number A63376. Address: Weldon F. Stump, 4835 Crestridge, Toledo 13, Ohio.

FOR SALE

One Used #3 Unit Drive Simpson Muller. Good condition. Address: Box 735, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOR SALE

B & P model 6024, 6000# hydraulic rollover draw machine complete and in excellent shape. 24" draw, 64" daylight, straight-in conveyor, 90° rollout conveyor.

B & P Rotomold, four roller conveyor station, pneumatically operated, 18' dia. indexing table, capacity 6000# per station, complete and in excellent condition.

Both may be seen in operation.

BOX 743, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

FOR SALE

2—1,000# Ingersoll Rand Air Hoists, Serial No. A-51830; A-55323 .....$300.00 Each

2—2,000# Ingersoll Rand Air Hoists, Serial No. A-21288; 60159 .....$400.000 Each

1—No. 2 Simpson Muller, Serial 80318, Inclosed Gear, 220-440V, 3 Phase, 60 Cycle ..$4000.00

All above equipment used but in excellent operating condition.

BOX 740, FOUNDRY

PENTON BLDG. CLEVELAND 13, OHIO

• FOR SALE

C. GREENE EQUIPMENT CORPORATION

GOOD USED

FOUNDRY EQUIPMENT

SPO Model 9546 Jolt, Rollover, Draw, squeeze machine late model
INTERNATIONAL Rollovers 30 x 8
INTERNATIONAL Rollovers 24 x 10
DAVENPORT Rollover model 34A Table 36 x 60
SPO Rollovers
INTERNATIONAL Jolt Pin Lifts all sizes
J & J Jolt Pin Lifts model 812S Table 30x38
SPO Rollover Pattern Draw Model RD 6815 table 36 x 68 draw 15"
INTERNATIONAL Plain Jolt machines
INTERNATIONAL Core Blower SB11
CHAMPION Model CB10 Core Blower
DEMMLER Core Blowers all sizes
REDFORD Core Blowers all sizes
SIMPSON No. 1 Muller Model UD
SIMPSON #1½ UD
CLEARFIELD 404 Muller
SIMPSON #1—open gear
PANGBORN Table Cleaning Machine Model LG6 with Aux. Tables 24" and Dust Collector
INGERSOLL RAND Air Compressor 100 hp. Pin Push-up machines
Dust Collectors—Many Sizes
WHITING Coal Pulverizers Model 30 and 30A
FISHER Aluminum Melting Furnace 300# Motorized Nose Pour, Gas Fired
INDUSTRIAL BRIDGE Cranes Motorized 1 ton Capacity 26' Span
INGERSOLL RAND Cupola Blower Centrifugal 5200 CFM, 20 oz. with 40 Hp. Motor
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Charging Cranes Monorail Type
TABOR Cut Off Saws
R-C Blower 18 x 54—7100 CFM 24 oz.
ROTOBLAST Model 14 GK w/dust collector
TESSMER Sprue Cutters
Ladles . . . All sizes open and enclosed gear
Steel Flasks Many Sizes
Air Hoists 500 lb. to 4000 lb.
Core Ovens, Drawer and Batch

B & P TRACTOR TYPE SLINGER
MANY MORE ITEMS AVAILABLE

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GOOD USED EQUIPMENT
FOR SALE

2 TABOR Squeeze in Head Molding Machines.
6 cu. ft. WONDER HOE Type Mixer 5 H.P. motor.
2 WADSWORTH stock Core Machines, with dies, tubes, trays, and cores to 7" motorized.
10 ton LOBED Trailer, 4 new 10 ply tires, hydraulic brakes, 16' by 79½" wide.
Abrasive Cut Off Saws. 12" & 14" wheels.
2000# HAUSFELD Nose Pour Melting Furnace with 3 new cast iron pots.
BAKER Shell Core Machine.
Large assortment of Flasks & Jackets.
Send for our lists.

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INTERNATIONAL FOUNDRY SUPPLY CO.
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JACKSON & CHURCH AUTOCLAVE
Vacuum Impregnator—Jacketed
54" x 72" — 150,000 Cu. Inch
Like New

GLOBE TRADING COMPANY
1815 FRANKLIN STREET
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SAND BLAST EQUIPMENT
SELL—BUY—TRADE
GUARANTEED MACHINES

TERMS: 3 YEARS TO PAY
Designers and Erectors of
Specialized Blast Equipment

6' Pangborn Swing Table	$6000.00
Pangborn GF2 Air bbl.	$ 450.00
Pangborn 1GF Air bbl.	$ 350.00
Pangborn 53 EN-2 Hand cabinet	$ 325.00
Pangborn Auto Peening cabinet	$1100.00
48 x 48 Wheelabrator Tumblast	$3000.00
42 x 48 Wheelabrator Tumblast	$2000.00
27 x 36 Wheelabrator Tumblast like new	$4000.00
36 x 42 Wheelabrator Tumblast	$1500.00
27 x 36 Wheelabrator	$2750.00
4' Wheelabrator Table Blast	$2000.00
6' Wheelabrator Table Room	$6000.00
4' Wheelabrator Table Room	$3000.00
6' American Tablast	$2200.00
Rumelin 8 x 8 room	$1000.00
Pressure Tanks, all types	$150.00 up
Vapor Blast cabinets	$ 400.00
Vapor Blast Automatic Table	$3000.00

All types and sizes of Hand Cabinets, Dust Collectors, Pressure Tanks, Rooms, Horizontal or Vertical Tumbling Barrels and additional Sand Blast Equipment too numerous to mention.
$100,000 worth of Wheelabrator and Pangborn Spare Parts Priced 25% to 50% Less List.

DIAMOND SAND BLAST EQUIPMENT CO.
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REPAIR AND REBUILDING SERVICE ON ALL PNEUMATIC TOOLS

We try to carry a complete line of "Hard Chrome Rebuilt Tools" at about half the cost of new tools. Before you discard your old tools, why not send them to us for our estimate on the cost of renewing them with our Hard Chrome Process?

CENTRAL PNEUMATIC SERVICE, INC.
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PHONE: CL 2-2701

FOR SALE

One "San-Blo" Core Blowing Machine
Model #40-P1-LPP
18" x 24" Table Size
LIKE NEW CONDITION

BEAVER VALLEY ALLOY FOUNDRY CO.
MONACA, PENNSYLVANIA

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FOR SALE
MOTOR-GENERATORS
TRANSFORMERS
Unused—Rebuilt
WORLD'S LARGEST INVENTORY
ELECTRIC EQUIPMENT COMPANY
Phone station Collect CL 4-9058
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FOR SALE

SIMPSON #2 U.D. Mix-Muller, Serial 37236, $800.00 spare parts (gears, pinions, plows and bearings)—including 25 HP motor, center water piping. Good Condition. (Replaced with larger machine) All for $6,000.00

UNUSED Diamond Flask Company core boxes, 1" to 6" diamond x 3 feet long—75% original cost. Ordered in error.

I.R. Air Weight Cupola Blower, all controls 25 HP, 20 oz.

BOX 739, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

AVAILABLE TOP QUALITY MODERN FOUNDRY EQUIPMENT

FORMERLY ALLIS-CHALMERS

NO. 2 FOUNDRY DISCONTINUED—BUILDING MUST BE CLEARED TO MAKE ROOM FOR NEW TRACTOR ASSEMBLY LINE

COMPLETE GRAY IRON FOUNDRY EQUIPMENT IN FIRST CLASS CONDITION AND ALL MACHINES UNDER POWER FOR INSPECTION

CONSISTING OF

SIMPSON MULLERS NO. 2 and 3
WHITING 25 ton cradle furnace
Complete with pulverizer (1957)
Apron Conveyors
DEMMLER Automatic Shell Core Machine
Elevators
INTERNATIONAL PK 18 Jolt, Squeeze, Lifts
SPO No. 2136, Jolt, Squeeze, Lifts
INTERNATIONAL No. SB 11 Core Blower
MILWAUKEE No. 125, Jolt, Squeeze, Lifts
(4) Mold Conveyor Lines (JEFFREY)
Belt Conveyors
Sand Hopper Lines up to 32 Stations
Bridge Cranes 1 ton to 6 ton
Clam Shell Buckets
Tower Core Ovens
WHEELABRATOR Tumblasts with skips 20 x 27 to 48 x 48
WHITING Tumbling Barrels
Cupolas No. 9 and 9½
Cupola Loading Systems
Dia-Electric Furnace
Complete Shell Molding Machine
Shakeouts and Screens
Air Hoists
Ladles
Electric Hoists
GARDNER Horiz. Grinder
DIAMOND face Grinder
Arc - Weldors
Escalators
Dust Collector

MANY MORE ITEMS TOO NUMEROUS TO MENTION PLUS MANY NEW SPARE PARTS
ALL ITEMS AVAILABLE FOR INSPECTION NOW—FOR INFORMATION AND PRICES

CONTACT MR. EARL GREEN—

WEISS STEEL CO., INC., ALLIS-CHALMERS FOUNDRY LIQUIDATION
BOX 2496—WEST ALLIS, WISCONSIN PHONE SPRING 47820

INSPECTION AT ALLIS-CHALMERS, 1126 S. 70 ST. GATE 7 WEST ALLIS, WISCONSIN (SUBURB OF MILWAUKEE).

Circle 867 on Page 39

EUCLID FOUNDRY & MACHINE EQUIPMENT CO.

14919 SARANAC ROAD CLEVELAND 10, OHIO

CLEANING EQUIPMENT
1—72" Swingout table
1—96" Swingout table
3—6 cu. ft. Continuous Tumblast
1—42" x 48", 17½ cu. ft. Tumblast with loader
1—36" x 42", 11½ cu. ft. Tumblast
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1—5' Table Airblast w/six aux. tables
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COPE and DRAG UNITS
Automatic Controls
21" squeeze cylinders
1—215 Milwaukee
1—217 Milwaukee
2—TDA-4 Taccone 24" x 24"

ELECTRIC FURNACES
1—3000 lb. Heroult Side Charge
1—500 lb. Lectromelt

MULLERS
Simpsons #1, 2, 3, unit drive
Clearfield #404, 610

LADLES-WHITING
4—25 Tons 2—15 Tons 2—10 Tons

CORE OVEN
1—Di-Electric Model M800-A
Thermonic, 30 KW

SANDSLINGERS
1—B-P 19" head stationary, double belt
1—B-P 19" stationary, riddle type

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Universal MACHINERY AND EQUIPMENT CO.

. . . large enough to serve you, small enough to know you.

1632 North Ninth Street
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25 hp INGERSOLL-RAND water cooled, horizontal
75 hp INGERSOLL-RAND water cooled, horizontal
100 hp WORTHINGTON air cooled, 2 stage

• BLOWERS
CENTRIFUGAL 5 Hp to 30 Hp
GE, WILBRAHAM—GREEN FISHER Positive Pressure & Cent., Cupola Blowers

• BLAST CLEANING EQUIPMENT

Over 80 rebuilt Wheelabrator units sold in less than two years.

72" WHEELABRATOR Swing Table
15" Cont. WHEELABRATOR Tumblast
26" Cont. WHEELABRATOR Tumblast
15" x 20" WHEELABRATOR Tumblast
20" x 27" WHEELABRATOR Tumblast
27" x 36" WHEELABRATOR Tumblast
36" x 42" WHEELABRATOR Tumblast
48" x 42" WHEELABRATOR Tumblast
48" x 48" WHEELABRATOR Tumblast
1-A WHEELABRATOR Multi-table
No. 2 WHEELABRATOR Multi-table
WHEELABRATOR Pipe Cleaning Cabinet
WHEELABRATOR Sheet Cleaning Cabinet, handles up to 48" wide stock
48" x 72" WHEELABRATOR Tumblast
PANGBORN 8' LF Table
PANGBORN Air Blast Room 6' x 8'
6' LK PANGBORN Table Room
6' LG PANGBORN Table
DUST COLLECTORS AND SKIP LOADERS AVAILABLE FOR ALL MACHINES

Just received from Gov't storage 48" x 42" & 27" x 36" WHEELABRATORS with skip loaders & dust collectors, at least 50% savings. LIKE NEW . . . ACT QUICKLY

• CONVEYORS
CARRIER Oscillating, 18" W x 54' L
HEWITT-ROBINS Oscill. 18" W x 40' L
HEWITT-ROBINS Vibrating, 18" W x 10' L Model VC-1
LINK-BELT, Car type mold, 114 cars, 403' track, car size 18" x 42"
LINK-BELT Oscillating, 18" W x 13' L
SIMPLICITY 17" W x 11' L, Model OA-10-KA Feeder
SIMPLICITY 24" x 10' Feeder w/hopper, Model OA-10-JA2
Roller Conveyor—Ask for List

• CORE BLOWERS
DEMMLER #1, #2, #2A, #3K
INTERNATIONAL SB-13
OSBORN #91, #192, #91-10
RANDALL MODEL "A" Bench Type
SAN-BLO #40-P-1, 40# core
TACCONE #4D, 10" Draw Stroke Cyl.

• DUST COLLECTORS
COMPLETE STOCK both Bag & Wet Types, 1000 to 15000 CFM

• FURNACES
DIRECT ARC MELTING
250 lb. LECTROMELT, Side Charge
500 lb. LECTROMELT, 200 KVA trans.
1000 lb. SWINDELL
2000 lb. HEROULT
2000 lb. Swindell, 3/60 1000 KVA
1½ Ton HEROULT
10' Top Charge Furnace
INDIRECT ARC MELTING
10# DETROIT
350# DETROIT LFA
750# DETROIT LFY, Conical Shell
1000# DETROIT AA
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INDUCTION MELTING & HEATING
30 KW, ECCO Hi-freq. Vacuum Melting
30 KW, LEPEL, water cooled spark gap
35 KVA, AJAX 60 cy., alum.
35 KVA, AJAX Spark Gap, High Freq. steel
75 KW TOCCO
GAS & OIL FIRED
400# & 600# FISHERS, MNP
1000# HAUSFELD Hand Tilt, Oil fired, alum or magnesium
1—#900 JC STROMAN, gas, Like new
6000# STROMAN, gas fired
20 Gas & Oil Fired Furnaces
HEAT TREATING
4' x 4' x 10' Gas Fired Annealing
9' x 12' Car Type, gas/oil
210 KW LINDBERG conveyor box type
7' Rotary G.E. 200 K.W. 1950° F
36" x 36" West. Pit Type Electric
10" x 12" x 24" LINDBERG, 2500° F. Hyd
42" x 73' G.E. Roller Hearth, 1950° F.
48 x 120, 48 x 144 gas fired
Large Stock Gas Fired Box Heat Treating Furnaces

• PIT TYPE ANNEALING
42 x 96, 42 x 120 recirculating gas fired

• GRINDERS
DOUBLE END
3 Hp HISEY WOLF 3/60/220
5 Hp U.S. Model 64, 3/60/220
7½ Hp U.S. Model 66, 3/60/440
10 Hp STANDARD 3/60/440
15 Hp MARSCHKE 220 volt
25 Hp KLING 3" dia. shaft
PEDESTAL
3 Hp CLEVELAND 3/60/440
5 Hp CINCINNATI 2/60/440
SWING FRAME
7½ Hp MUMMERT-DIXON 2/60/220-440
10 Hp SAFETY 24" x 3" wheel
15 Hp MARSCHKE 3/60/220-440
15 Hp MUMMERT-DIXON

• LADLES
BOTTOM POUR
MODERN 49" x 49"
MODERN Crane Type, 55" H x 50" top
MODERN Crane Type, 60" H x 60" top
LIP POUR
WHITING 52" x 52" top dia. geared
CYLINDRICAL
WHITING, 26" L x 25" dia, 1100# iron
WHITING, 19" L x 22" dia, 600# iron
WHITING, 38" L x 28" dia, 2200# iron

• MATERIALS HANDLING
BYERS Mobile Crane, BUDA Engine, 50' Boom, 5 ton w/magnet & bucket
HOUGH PAYLOADER, Model HA, 1000# cap., hyd. lift, mech. dump

• MOLDING MACHINES
JOLT ROLLOVER PATTERN DRAW
DAVENPORT #40SA, 40" x 60" table, 3000#
HERMAN 10,000# 48" x 109" table
HERMAN 6000#, 42" x 78"
HERMAN 7500#, 40" x 50" table
HERMAN 3000#, 30" x 66" table
HERMAN 3000#, 32" x 70", 15" cyl. series charging conveyor type
HERMAN 1500#, 30" x 48" table
INTERNATIONAL 27" x 16", Type F, 22" x 64" table
INTERNATIONAL 31" x 16", Type F, 28" x 31" table
INTERNATIONAL 30" x 12", Type G, 28" x 35" table
INTERNATIONAL 13" x 17" table
OSBORN #602, 36" x 26", 900#
OSBORN #405, 3000#, flask 64" x 57"
TABOR 40" x 60", 1500 & 3000#
TABOR 22" x 42" pattern draw shockless, portable 600#
TABOR 20" x 30", w/air clamps, 1000#
TABOR 14" x 16" Rockover 150#
TABOR 40" x 50" table 3000# capacity
PLAIN JOLT
INTERNATIONAL, 3' x 4' Table, 12" cylinder
TABOR 3' x 4' table
JOLT PIN LIFT
HERMAN #1317, 22" x 30" table
INTERNATIONAL JDP, 1200 x 8", 24" x 26" table, 8" draw, 1200# port.
SPO #305, 750 lb. 20" x 27" table
TABOR 20" x 24" table, 600#
JOLT SQUEEZE PIN LIFT
INTERNATIONAL PKL, 20" x 28" table, 14" sq. 5½" draw
INTERNATIONAL PKL, 18" x 24" table, 12" sq., 5½" draw, stat.
MILWAUKEE #163, 15" x 24" table, 11" sq., 1500#
MILWAUKEE #165, 24" x 30" table, 16" sq., 1700#
NICHOLLS 18-44, 6½" draw
OSBORN, #712J, #712PJ, 18" x 28" table, 12" sq., 6" draw, stat. & port.
OSBORN #716 PJ, 22" x 34" table 16" sq., 8" draw
SPO #2114P, 21" x 27" table, 600#
SPO #2116, 21" x 27" table, 11" sq., 6" draw
JOLT SQUEEZERS
INTERNATIONAL #12 LJS, 16" x 20"
INTERNATIONAL #10 LJS, 16" x 20"
OSBORN #275J, 16" x 20" table, 400#
SPO #110J, 17" x 20" table, 400#
TABOR Squeeze-in Head, 16" x 19" table
TABOR Yoke Type, 18" x 26" table

• MULLERS AND MIXERS
B&P #30 Speedmuller w/skip, 3 cu. ft.
B&P #40 Speedmuller w/skip, 5 cu. ft.
B&P Conventional, SIMPSON type, 87½" Dia., arranged for cooling
CLEARFIELD #610, 6' dia., 14 cu. ft.
SIMPSON, #0, U.D., 3' Dia.
SIMPSON #1, Sep. Dr., 4' dia., 4 cu. ft.
SIMPSON, #1½, U.D., 4'6" dia., 6 cu. ft.
SIMPSON #1½, Sep. Dr., 4'6" dia., 6 cu. ft.
SIMPSON #2, enc. gear or open gear, 6' dia., 14 cu. ft.
SIMPSON #3, 8' Dia. Sep. Dr., 30 cu. ft.
SIMPSON #3, U.D., 8' dia., 30 cu. ft.
WHIRLMIX, 31" dia., 200 to 300 lb. sand

• OVENS
COLEMAN, Gas, 2 Comp. and 5 drawers, O.D. 22' x 12' x 10'
GIRDLER Thermex Dielectric Core Oven, 15KW w/36" W mesh belt

• PRESSES
40 Ton FERRACUTE Sprue Cutter 1½" stroke
125 ton R.D. WOOD Down acting, 9" stroke
NIAGARA No. 82 Punch Press

• SAND CONDITIONING
B&P Nite-Gang
B&P Screenarator, Model "M"
LINK-BELT Revivifier
ROYER, NC-2, 10-15 tons/hr, 1½ Hp
ROYER PREPARATOR, Comb., Model NDC, 25 ton/hr scrap removal 8' x 8' hopper
ROYER, NDP, 15-25 tons/hr, 2 Hp
ROYER, "NRP," 40-60 tons/hr, 5 Hp.

Sand Handling System
NATIONAL ENGINEERING UNIT
Inc.: #1½ Simpson U.D. Muller w/water meter, National Screen Master Preparator, skip bucket loaders, 20"x20' belt conveyor, "Elevayor", 2 Moulder's Helpers (4 stations)—1957 unit LIKE NEW — LOW LOW PRICE!

• SAND SLINGERS
B&P Stationary, Single Speed
B&P Tractor Type 16" Head
B&P Tractor Type 19" Head

• SHAKEOUTS
2' x 10' HEWITT-ROBINS
3' x 10' SIMPLICITY
4' x 5' SIMPLICITY
4' x 6' SIMPLICITY
4' x 8' SIMPLICITY
5' x 6' HEWITT-ROBINS
5' x 8' HEWITT-ROBINS

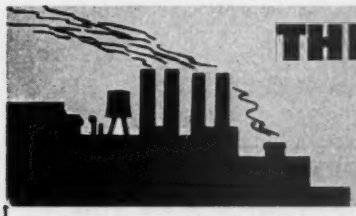
• TESTING MACHINES
100,000 lb. Olsen UNIVERSAL Tensile
3000 Kg Gogan Brinell Testers

• TRANSFORMERS (Furnace)
100 KVA KUHLMAN 13,200, 1/60
250 KVA WESTINGHOUSE 6600, 3/60
300 KVA WAGNER 4600, 1/60
500 KVA KUHLMAN 13 200, 1/60
800 KVA PENNA, 23,000, 3/60
1000 KVA WESTINGHOUSE 23,000, 3/60
1000 KVA G.E. 13,200, 3/60
2000 KVA WESTINGHOUSE 13,200, 3/60
5000 KVA WESTINGHOUSE 2300, 3/60
7500 KVA PENNA, 13,200, 3/60

• TUMBLING BARRELS
SLY 68" x 32" round
SLY 48" x 36" round

• MISCELLANEOUS
BLASTCRETE Model PM-1 Cupola Gun
FLASKS, CORE PLATES, All Sizes
CLIMAX Model 2-A Wire Straightener
62" Magnet
MOULDER'S Hoppers, Various Sizes
TABOR 10 HP Cut-off Saw

Your *DEPENDABLE* Foundry Equipment Dealer



THE ACME bargain page

AERATOR
NEWAYGO

BLOWERS
I.-R. 12900 cfm, 100 h.p. 220-440 V, 20 oz.
GE 10500 cfm., 20 oz., 85 h.p., 220 V.
GE 7500 cfm., 20 oz., 89.6 h.p., 220-440 V.
SPENCER 7350 cfm., 16 oz., 50 h.p.
GE Centrifugal 6200 cfm., 24 oz., 58 h.p.
6000 cfm. INGERSOLL-RAND 32 oz.
SPENCER 3500 cfm., 20 oz., 40 h.p.
SPENCER 2250 cfm., 16 oz., 15 h.p., 220
SPENCER 1350 cfm., 32 oz.
NORTH AMERICAN 1050 cfm, 16 oz.
NORTH AMERICAN 850 cfm.
500 cfm NORTH AMERICAN 12 oz.
McKee 200 cfm

BUCKET ELEVATOR
33' Newaygo 12" x 7" Buckets
28' Newaygo 12" x 7" Buckets

CLEANING EQUIPMENT
27" x 36" American w/skip
36" x 42" American w/skip
48" x 62" American w/skip
48" x 48" AMERICAN w/skip
6' Table PANGBORN
AMERICAN #2 Tablast 8-28" tables, late
PANGBORN GD1-Airblast Barrel

CONVEYOR
17' BARBER GREEN Bucket Conveyor

CONVEYORS, OSCILLATING
24" x 40' Ajax
SIMPLICITY 18" x 24'
SYNTRON 24" x 6'
AJAX 12" x 20'6"
36" x 11' Ajax
8" x 13' Ajax

CORE BLOWERS
CB15 55# cores, Universal blow plate
DEMMLER #4 up to 250# cores
DEMMLER #50
1—DEMMLER #55 w/vibratory hopper
2—DEMMLER #55 w/plain hopper
DEMMLER 2EO
DEMMLER 2K
FEDERAL "SAN-BLO" CB 40
INTERNATIONAL SB15H, up to 150# cores. Hydraulic clamp and draw
INTERNATIONAL SB 13, up to 60# cores
6—OSBORN 193 up to 50# cores
REDFORD #2 & #4

CORE GRINDERS
5—MILWAUKEE 70-9 & 70-12s

CORE OVENS
THERMONIC INDUCTION MODEL 1800A
2—Despatch ET. Drawer Type

CORE ROLLOVERS
INTERNATIONAL REDP Rollover 12" draw
SUTTER #500

CRANES
10 ton MILWAUKEE: 48' span, 220 V.

CUPOLA GUNS
1—Bondactor #1250 and 1000

CUTOFF SAWS
DEWALT CUTOFF SAWS for ferrous or nonferrous metals, cutoff or as sprue cutters. Flush blade adapter takes up to 20" abrasive blade or saw. Power Hoist to arm. Chain & Sprocket cross feed for working on heavy cast iron 48" x 60" "T" slot table or off table cutting of large work. Motor swivels horizontal to vertical in yoke.

DUST COLLECTORS
PARSONS 40,000 cfm, cloth bag type

ELECTRIC MELTING FURNACES
1—DETROIT "LFA" 350# shell 13200 V.
1—DETROIT "LFC" 700# and 350# Tapered Shell 2300 V.

FURNACES
400# Fisher Motorized Tilt, Gas Fired
600# Fisher Stationary
600# Campbell Hausfeld Brass

GRINDERS, MISC.
U.S. #70 Comb. 20" disc & 20"x3"x1½" wh
GARDNER 18" single end disc.
GARDNER 26" D.E. Disc
Porter Cable BG 8 8" belt
72" Gardner Horizontal Disc
53" Hanchett Horizontal Disc

GRINDERS, SNAG
US #64 D.E. 20" x 3" x 10"
#5 Fox Sgl. Wh. 24" snag.
2—KLING H.D. 24" x 3" x 12" D.E.
KLING H.D. 20" x 2" x 7" D.E.
5—#6 FOX Single Wheel 24" Snag
U.S. #65 D.E. 30" x 3" x 12"

GRINDERS, SWING FRAME
FOX 24" x 3" x 12", 15 h.p.
MARSCHKE 24" x 3" x 12" 20 h.p., 220 V.
U. S. 24" x 3" x 12" 15 h.p., 220-440 V.
2—MARSCHKE 3 p.h., 12" wheel
1—B&D 7½ h.p.

HEAT TREATING FURNACES
G. E. Elevator Type 1950° Atmosphere Generator 65" x 16' car. Electric. Late
G. E. Elevator type 2150°—96" x 144" car atmosphere generator. Electric. Late
LINDBERG 1250° 48 x 60 Electric
3—ABBOTT 24" H x 22" Deep x 30" Wide, Gas Fired
HOLDEN #202 1850° Bright Hardening Annealing
25 KW Westinghouse 2000°

HOISTS
6000# Cleveland, w/monotractor travel
6000# Electrolift
4—2000# R & M
4—CLEVELAND 2000# Cab type hot metal carriers
1—500# Ingersoll-Rand LC-4

INDUCTION MELTING EQUIPMENT
30 KW Lepel Spark Gap
35 KW Ajax Tama Wyatt, 60 cycle Induction holding furnaces
1000# Ajax Spare Melting Furnaces

LADLES
WHITING 16000# Crane
WHITING 8000# Crane
WHITING 5000# Crane
4000# Industrial Holding

MOLD BLOWER
TACONNE TD4 24" x 32" flask

MOLD CONVEYOR
366'—51—44" x 66" cars

MOLDING MACHINES
JOLT SQUEEZE PIN LIFT
8—OSBORN 712 PJ 18" x 28" table
1—CHAMPION JSL10P 18" x 21" table 6" draw
8—MILWAUKEE 2646 Jolt Squeeze Strip rolloff—rolling molding machines 10" jolt cylinder; 1800# capacity, 26" Squeeze cylinder; 13" draw. Flask size 25½" to 29" wide, 52" long. FACTORY REBUILT.
2—MILWAUKEE 165, 24" x 30", 8" draw
MILWAUKEE No. 145-2, 27" x 30" table
JOLT SQUEEZERS
2—CHAMPION JS10P 18" x 21" table
2—OSBORN 275PJ
2—MILWAUKEE 244 Jolt Squeeze car type head
MILWAUKEE 181-7, 24" x 36" table
113 PJ SPO
25—124 Milwaukee Portable Jolt Sq.
6—104 Milwaukee Portable Jolt Sq.
MILWAUKKE #162—1, 900 lbs cap.
JOLT ROLLOVER DRAWS
HERMAN 3000#
2—750# HERMAN 20" x 30" table
1—INTERNATIONAL RJ 20" x 12"
1—SPO 9032
3—SPO 506
1—SPO 506 SP
DAVENPORT #24—SA
2—INTERNATIONAL G
1—TABOR 30 x 52
JOLT SQUEEZE ROLLOVER DRAW
OSBORN 331-332-333
SPO 413D
INTERNATIONAL RES.
PLAIN JOLT
36" x 60" Herman

MULLERS and MIXERS
#30 B&P w/skip loader
1—#3 UD Simpson
1—930 Clearfield
CLEARFIELD #404
1—#2 SIMPSON OG
CLEARFIELD #610
CLEARFIELD—Laboratory

SAND CONDITIONERS
AMERICAN 51"
ROYER NDC—ND2
SCREENARATORS S-M-L

SAND SLINGERS & EQUIPMENT
3—19"—2 speed Stationary
2—14' Turntables
1—12' Turntable
4—7' Plate Feeders, 35 & 45 Tons

SAND SYSTEM EQUIPMENT
33' Newaygo Bucket Elevator 12" x 7"
28' Newaygo Bucket Elevator 12" x 7"
4—7' B&P Plate Feeders, 35 & 45 Tons
2—18" x 52' Magnetic Belt

SAWS, BAND
30" LAIDLAW, Metal Cutting hydraulic

SHAKEOUTS
3' x 10' SIMPLICITY
5 x 10 LINK-BELT
4 x 8 LINK-BELT
2' x 8' Double Deck

SHELL EQUIPMENT
SHELL PROCESS 20" x 30" pattern size w/shell blender and bonding press

SHOT BLAST
SLY #4, 20" x 30" w/dust collector

SLAG DISPOSAL UNIT
AMERICAN MODEL A

SPRUE CUTTERS
1—MILWAUKEE #85 TON
OBERMAYER 2 H.P.

STRAIGHTENING PRESS HYDRAULIC
225 ton Southwark
150 ton Farquhar "C" Frame
100 ton Elmes Hydraulic
100 tons Hannifin Hydraulic
60 ton Lempco 4 post
60 ton Farquhar "C" Frame
25 ton Fox
25 ton Dennison

TESTING EQUIPMENT
ARLIN Automatic Rockwell, continuous
COLEMAN 55 Spectrophotometer
GOGAN Model 1414-2V

TUMBLING BARRELS
ROTO-FINISH Model DW 45-36
1—ROYERSFORD, 42" x 72", chain drive
SLY, 24" x 48"; 3 H.P.
SLY, 30" x 60" Duplex

TUMBLING MILLS
30" x 60"

WOODWORKING—PATTERNSHOP
HERMANCE 24" Planer
JONES SUPERIOR 48" Double Disc
OLIVER #290 Dbl Arbor, Tilto-Arbor Saw
1—OLIVER 182D, 15" Disc Sanders
CRESCENT 24" planer
6", 8", 12" and 30" Jointers
20" Yates American Band Saw

ACME

ACME EQUIPMENT CO., INC.

We will buy for cash a single piece of equipment or your entire plant

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MONA

DEPENDABLE SERVICE
QUALITY EQUIPMENT
GUARANTEED SAVINGS

PARTIAL LISTING OF EQUIPMENT NOW AVAILABLE — INQUIRIES INVITED

CUPOLA BLOWERS

MODEL	C F M	PRESSURE	HP
INGERSOLL RAND			
FS-337	3000	20 oz.	25
FS-365	4500	16 oz.	30
FS-355	6000	16 oz.	40
FS-387	10,200	20 oz.	75
FS-377	10,500	20 oz.	85
FS-565	14,100	40 oz.	200
ROOTS CONNERSVILLE			
RCR	1040	20 oz.	10
RCS	9075	32 oz.	100
SPENCER TURBO			
2025H	1850	32 oz.	25
Cont.	7500	48 oz.	150

PANGBORN LK-6' Dia. Table-Room Rotoblast, Max. height of work 36", max. weight on table 5000#. Table speed 2.4 RPM. Pitless type. New 1952. Serial #6LY-5110.

SAND MULLERS

MODEL	PAN DIA.	CAPACITY
CLEARFIELD		
404	4'	400#
610	6'	1500#

BEARDSLEY & PIPER

MODEL	CAPACITY	AIR COOLED
30	4 cu. ft.	Yes
30	4 cu. ft.	No
60	12 cu. ft.	Yes
60	12 cu. ft.	No
70	15 cu. ft.	No
80	20 cu. ft.	Yes

ALL CAN BE EQUIPPED WITH DUST HOODS, SKIP HOIST LOADERS, MULTRAMATIC CONTROLS, ETC.

2—B&P #3½ Mulbaros.
1—SIMPSON Porto-Muller.

MODEL	PAN. DIA.	CAPACITY	DRIVE
SIMPSON			
0	3'	175#	Sep.
1-H	4'	500#	UD
1½	4'-6"	700#	UD
2	6'	1500#	UD
2	6'	1500#	Encld.
3	8'	3000#	UD
3	8'	3000#	Encld.
3½	9'-3"	5000#	UD

ALL CAN BE EQUIPPED WITH NATL. ENG. STRAIGHT LIFT SKIP HOIST BUCKET LOADERS.

MODEL	PAN. DIA.	CAPACITY
LANCASTER		
EA4	59"	9 cu. ft.
EBG-4	59"	9 cu. ft.

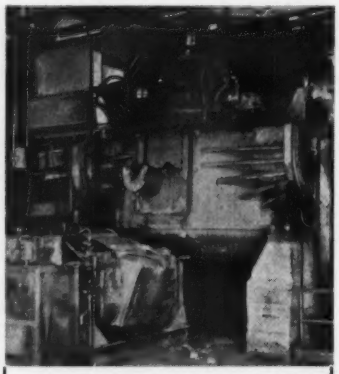
JOLT SQUEEZE PIN LIFT MACHINES

MODEL	TABLE SIZE	DRAW	DIA.	CAP.
PKL-12	18" x 24"	5½"	12"	600#
PKL-14	20" x 28"	5½"	14"	1000#
PK-16	20" x 30"	8"	16"	1700#
MILWAUKEE				
125	21" x 27"	8"	12"	1200#
145	24" x 30"	8"	14"	1700#
195	28" x 39"	10"	19"	3000#
196	16¾" x 39"	10"	19"	3000#
244	22" x 32"	12"	24"	3000#
245	35¼" x 42"	12"	24"	5900#
246	23¾" x 42"	12"	24"	5900#
OSBORN				
710-PJ	16" x 25"	6"	10"	500#
712-PJ	18" x 28"	6"	12"	750#
714-PJ	20" x 31"	7"	14"	1000#
716-PJ	22" x 34"	7"	16"	1250#
SPO				
2114-P	20" x 27"	4"	11"	600#
2136	21" x 30"	6"	13"	800#
2146	22" x 31"	6"	14"	1000#

JOLT SQUEEZE ROLLOVER DRAW

MILWAUKEE

MODEL	TABLE SIZE	DRAW	CYL.	CAP.
167	32" x 33"	12"	16"	1000#
OSBORN				
332	26" x 36"	9"	16"	750#
333	32" x 45"	11"	19"	1400#
SPO				
413-C	24" x 25"	10"	13"	600#
917-A	26" x 36"	9"	17"	750#



WHITING 10-TON HYDRO-ARC FURNACE
10' dia. shell, 6'-8" inside depth, 1" steel plate. Cradle tilt, manual & motorized, 9" dia. electrodes. Capacity—18 to 23 tons cupola malleable iron per hour. Holding capacity—16 tons normal, max. 21 tons.
1—ALLIS CHALMERS 2000 KVA Furnace Transformer, 12,000 volt primary, OIWC motor operated tap changer. Entire unit new 1952.

OSCILLATING CONVEYORS

AJAX ENGINEERING (Lo-Veyor)

MODEL	SIZE	CAPACITY in T P H
LC 18-6-24	18" W x 24' L	50
LC 24-6-7	24" W x 7' L	70
LC 24-6-21 FA	24" W x 21' L	70
LC 36-6-9 DA	36" W x 9' L	100
LC 36-6-14 DA	36" W x 14' L	100
HEWITT-ROBINS		
VC-6	24" W x 120' L	55
VF-3	30" W x 5' L	12
LINK-BELT		
Flexmount	8" W x 70' L	15
SIMPLICITY ENGINEERING		
OA-10-JA	24" W x 13' L	150
OA-10-JA	24" W x 11' L	150
OA-10-JA-2	30" W x 7' L	150
OA-10-JA	30" W x 13' L	100
OA-10-JA	36" W x 6' L	150
OA-10-A	36" W x 10' L	200
OA-10-A	36" W x 16' L	200
OA-10-A	36" W x 25' L	600

SANDSLINGERS

B&P Stationary, Model "DB," 5' jib arm, 4' ram, 19" head, 5" cup, 2-speed, 20/13 HP. Raising & lowering arms or fixed.
B&P Stationary, Model "DB," 8' jib arm, 4' ram, 19" head, 4" tip, 20/16 HP. Raising & lowering arms or fixed.
B&P "Motive Jr.," 11' jib arm, 4' ram, 16" head, 4" cup, R & L arms, 2-speed, 20/13 HP.
B&P "Motive," 15' jib arm, 9' ram, 2-speed, 25/16 HP. With Raising & Lowering Arm.

HANDY SANDY'S

NEWAYGO SHS-4-G Super Handy Sandys, Single Hopper, 15 cu. ft. capacity, 4' receiving hopper, air gates, 21' center elevator.
NEWAYGO SHS4-GT Super Handy Sandy, Twin Hopper, 25 cu. ft. capacity, 4' receiving hopper, 21' center elevator.
NATIONAL ENGINEERING Moulders Helper, Twin Hopper, 3000# capacity, each air operated gates.

JOLT PIN LIFT MACHINES

DAVENPORT

MODEL	TABLE SIZE	DRAW	CAP.
34 A-JS	36" x 46"	12"	2500#
INTERNATIONAL			
JDP 1200x8	24" x 26"	8"	1200#
JDP 3000x10	48" x 48"	10"	3000#
JL	32" x 52"	12"	2000#
JOHNSTON & JENNINGS			
68-SP	25" x 30"	8"	600#
812-S	30" x 38"	12"	1600#
MILWAUKEE			
1030	28" x 34"	8"	1000#
1536	32" x 38"	10"	1500#
2036	32" x 38"	10"	2000#
2542	38" x 42"	12"	3000#
3548-6	44" x 46"	12"	3500#
OSBORN			
540	32" x 52"	12"	2000#
560	32" x 45"	12"	2500#
SPO			
3070	26" x 35"	10"	1500#

JOLT ROLLOVER PATTERN DRAW

DAVENPORT

MODEL	TABLE SIZE	DRAW	CAP.
24 SA	24" x 38"	12"	1000#
28 SA	28" x 40"	12"	1500#
34 A	34" x 58"	15"	2500#
48 A	48" x 82"	24"	6000#

1—INTERNATIONAL Model "AN," Air Clamp, Air Turnover, Air Draw-Molding Machine, 4500# capacity. Flask—40" width by open ends. Draw 20". New 1952. Used six months.

MODEL	TABLE SIZE	DRAW	CAP.
JOHNSTON & JENNINGS			
612	24" x 30"	12"	600#
815	30" x 40"	15"	1200#
918	44" x 54"	20"	2000#
920-RC	44" x 54"	20"	2000#
1020-RC	50" x 60"	20"	3000#
OSBORN			
242-W	29" x 42"	12" to 19"	1500#
244	35" x 52"	16" to 25"	3000#
405	57" x 64"	26"	3000#
442	21" x 31"	10"	600#
601	24" x 30"	10"	900#
602	30" x 36"	12"	1200#
643	35" x 50"	20"	2000#
SPO			
505	18" x 23"	6½"	400#
506	24" x 25"	10"	600#
TABOR			
22"	22" x 32"	10"	600#
22"	22" x 42"	10"	600#
30"	30" x 40"	12"	1000#
40"	40" x 60"	15"	3000#

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"Built on a Foundation of Mutual Trust"

10900 CEDAR ROAD • CLEVELAND 6, OHIO • SW 1-3900

Circle 871 on Page 39

. . . . *a trademark to remember* . . . . *a name to trust* . . . . .

FOUNDRY
ENGINEERING
SERVICE

HN

FOUNDRY
EQUIPMENT BY
FOUNDRYMEN

HAMLIN-NAGEL, INCORPORATED

Box 192, EDWARDSVILLE, ILLINOIS, *In Metropolitan St. Louis*, PHONE 3864

SAND SLINGERS
B & P Tractor type, 6' jib, 4' ram arm, 18" head.
B & P Stationary Riddle Type 6' Jib, 4' Ram Arm, 19" Head.

MECHANIZED MOLDING SYSTEM
Jeffrey 16 station Overhead Sand System, includes sand storage, muller, mold conveyor, shakeout and sand return.

JOLT SQUEEZERS
Osborn 275J
International LJS 10"—12"
International PJS 16"
Tabor Top Squeeze 10"
SPO 110J—113J
Champion 10"
Milwaukee 104-5—10"—12"
SPO 2136

JOLT SQUEEZE PIN LIFT
Milwaukee 126 Portable 21 x 27 Table 8" Draw
Milwaukee 145 24 x 30 Table 8" Draw
Osborn 712 18 x 28 Table 6" Draw

International PK18 18" Sq. Cyl 8" Draw 24 x 36 Table

JOLT ROLLOVER DRAW
International "G" 30 x 12
International "F" 45 x 72 x 16" Draw
J&J 612, 25 x 30 x 8" Draw
J&J 815, 30 x 40 x 15" Draw
J&J 918 44 x 54 table, 18" Draw
Osborn 405 39 x 63 table
SPO 508, 28 x 30 x 9" Draw
Tabor 30 x 50 x 12" Draw Shockless

JOLT PIN LIFT
Davenport 34A, 36 x 46 x 12" Draw
J&J 12168, 36 x 54 x 16" Draw
J&J 688, 24 x 30 x 6" Draw
Milwaukee 1536, 32 x 38 x 10" Draw
Osborn 558 20" x 24" x 5" Draw
SPO 3070

JOLT SQUEEZE ROLLOVER DRAW

SPO 9546, 30 x 40 Flask 11" Draw
SPO 920, 32 x 44 Flask 11" Draw
Osborn 332, 26 x 36 Flask 9" Draw

PLAIN JOLTERS
J&J 72 x 72
Tabor 48" x 60"

SAND MULLERS
Simpson Lab Muller
Simpson Portomuller
Simpson 1½ UD w/or w/o skip hoist
Simpson No. 1, Style "H"
Simpson #2 w/skip (open gear)
Simpson #3UD auto-cycle, dust hood, etc.
B&P No. 3½ Mulbaro
B&P #60 w or w/o Multromatic
Clearfield 610
Clearfield 920 w/skip
Carver CO_2 Sandmixer 130# cap.

SAND CONDITIONERS
B&P Screenarators, M. L.
50" Molders Friend
Royer NDP, Royer NC2, Royer JR
American Sand Cutter, various sizes
B&P No. 60 Preparator
3 Newaygo Handy Sandys HS7GT
1 Reddy Sandy

SHAKEOUTS
Allis Chalmers 4 x 6
Simplicity 3 x 5
Newaygo Reddy Sandy
Allis Chalmers 8 x 10
Simplicity 4 x 6

CORE BLOWERS
Redford No. 1 and No. 2
Champion, CB15, CB18
Demmler No. 55, 1, 2K, 3E
Hansberg Shooter
Demmler 103EO w/feeder skip hoist, semi-auto cycle
Ross Vibra—Draws

CORE OVENS
Tower oven, various sizes
Batch type. Core & mold drying, various sizes
Porbeck 16-2B double and single end five drawer
Foundry Equipment, single end, 5 drawer

CUPOLAS
Whiting Nos. 0, 2½, 4, 5, 7, 9, 10
Cupola Blowers, various sizes
Modern swivel charger
Hauck cupola lighter
Series 1000 Bondactor
Cupoliner Model 1500

LADLES AND POURING DEVICES
Modern, Whiting, all sizes plus mixing ladle, electric tilt, cylindrical and tea pot lip pour

NON FERROUS FURNACES
#60 to #250 Crucible & Iron Pot Furnaces, stationary and tilt
Lindberg Fisher Electric Induction
Reda 1000# power tilt type reverberatory
Stroman 1600#/hr. reverberatory, 1 station double chamber reverberatory
6000# Fisher Simplex reverberatory complete, gas fired
Lindberg Fisher NMP nose pour, 1000# capacity, gas fired

CLEANING EQUIPMENT

48 x 72 American Wheelabrator with skip and dust collector

42 x 48 American Wheelabrator
36 x 42 American Wheelabrator with skip & dust collector
27 x 36 American Wheelabrator with skip & dust collector
20 x 20 Air Blast Sly Barrel
No. 3 Pangborn continuous Wheelabrator with feeder & dust collector
36 x 72 Sly Tumbling Barrel, gearmotor drive

GRINDERS
Marschke 2 x 24
U. S. No. 64, variable speed
U. S. No. 65, variable speed 24"
Gardner 54" surface grinder
Mumert-Dixon Swing 15 HP 3 x 24"
Gardner 36" opposed wheel surface grinder

AIR COMPRESSORS
25 H.P. Air Cooled I.R.
100 HP XRB Ingersoll-Rand 2 stage, horizontal
175 HP XRE 2 stage, synchronous motor
30 HP Ingersoll-Rand horizontal

AIR HOISTS
Ingersoll-Rand 700#, 1000#, 2000#, 4000#, and 10,000#
Curtis Air Cylinder Hoists

ELECTRIC HOISTS
P & H 500#, 1000#
Comet 500#
Cleveland 1000#
Yale 1000#, 6000#
Budgit 1000#

MATERIAL HANDLING EQUIPMENT
Hough Payloaders HA Models
Hyster Forklift 2000#
Clark Forklift 6000#
Towmotor Forklift 7000#
Baker Electric platform 6000#
D. C. Electric Clamshell 1½ Yard
Clamshell Buckets ¾ & 1 Yard
45" Bolted ECM Magnet
50" Bolted Ohio Magnet
55" Bolted Ohio Magnet
130' of 30" roller conveyor, 3½ rollers, 6" centers, 4" channels

2—3 ton Shepard Niles overhead cab operated cranes, 47' span with runway and motor and generator.

TESTING EQUIPMENT
Sand Testing Equipment
Speedy Moisture Teller

MACHINE SHOP EQUIPMENT
Cincinnati #118 automatic mill
Betts 52" Vertical Boring Mill, 2 loading arms
Niles Radial Drill 13" x 5' arm
American Radial Drill 14" x 7' arm
Welding Positioner, 6000# Cap.
2 Foster turret lathes, serials 5U759 and 5U760, 21" swing, 2" spindle, 2 and 3 jaw chucks, cross-slide, coolant.

MISCELLANEOUS EQUIPMENT
Tessmer, Obermayer, Perkins ¾", 1½" blades, sprue cutters
Walker Turner all angle cutoff saw
C & P core knockout
Magnetic Pulleys
Steel Flasks
Slip Flasks, Jackets
500# Print-O-Matic Dial
American Rod Straightener Type F & H

PATTERNS FOR PRODUCT LINE
Approximately 50 matchplates and other patterns to produce a line of brass plumbing supplies, all jigs, fixtures, dies and special tooling, approximately $7000 *cost* stock finished parts on hand, National Sales distribution of products produced, list of customers and sales representatives.

WANTED! GOOD SURPLUS EQUIPMENT . . . . . .

Blast It Better!

Add bigger savings with
ARROW-BLAST abrasive*

Pressure blasting saves you time and trouble in plenty of metal cleaning jobs.

But that's only part of the economy story.

With Norton ARROW-BLAST abrasive you get other important savings. ARROW-BLAST abrasive is composed of ALUNDUM* fused alumina grains — characteristically hard and sharp for extra fast cutting action — tough, strong and blocky for high resistance to breakdown.

That's how ARROW-BLAST abrasive assures longer, more useful service life and lower cleaning costs. Also, contrasted with sand-blasting, ARROW-BLAST abrasive cleaning eliminates hazards. Dust is held to a minimum, allowing maximum visibility.

For maximum savings in compression cleaning, add Norton NORBIDE* pressure blast nozzles. Molded of the man-made material that's next to diamonds in hardness, NORBIDE nozzles last longer than any other you can buy, and give exactly the type of cleaning stream you need, from broad to pencil-thin. For quick service on ARROW-BLAST abrasive and NORBIDE nozzles, see your Norton Distributor. Or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

*Trade Marks Reg. U.S. Pat. Off. and Foreign Countries

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625 pages,

334 illustrations

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A comprehensive work giving detailed data on the chemistry, metallurgy and technology of steel castings. Provides complete information on methods of technical and industrial control in production of steel castings and describes every manufacturing process used.

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here's why

YOU CAN'T AFFORD OLD-STYLE RAMMERS!

I-R Size 241
Sand Wiper Floor Rammer

NEW SAND WIPER FEATURE ON I-R RAMMERS CONVINCES ONE OF WORLD'S LARGEST FOUNDRIES

A tiny $1.35 repair bill after almost 1500 hours of continuous service (about 9 months on an average job) was all the proof they needed. This was the total cost of a replacement *Sand Wiper* piston seal that was designed to fail before allowing sand or abrasive grit to enter the air cylinder.

Without *Sand Wiper* protection, no rammer can give you this kind of economical, trouble-free service. And *Sand Wiper* is an exclusive I-R Air Engineering Extra! Others:

- **Piston Rod Air Seal**
  Provides positive air-tight seal around piston rod with minimum of friction.
- **Continuous Lubrication**
  From built-in grease chamber that keeps piston rod lubricated.
- **Chrome-Plated Piston**
  Rides in smoothly honed pearlitic iron barrel to reduce friction losses by 65%.
- **Built-In Cooling**
  Cooled exhaust air keeps barrel from getting hot at the grip.
- **Rubber-Faced Throttle Valve**
  Neoprene valve face prevents air leaks common in metal-to-metal seals.

For more details or a convincing demonstration of these money-saving Air Engineering Extras, call your nearby I-R representative.

62A-8

Ingersoll-Rand
11 Broadway, New York 4, N.Y.

Planned Annual Retooling increases output per man

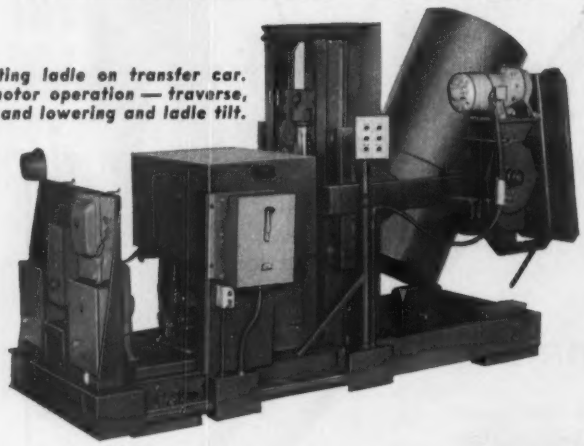
Circle 695 on Page 39

MODERN -WAYS PLUNGING INOCULATING

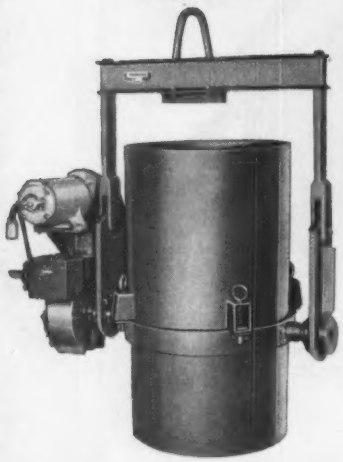
LADLES ENGINEERED TO YOUR NEEDS!

Plunging the alloy into the molten metal, holding down on the reaction and shielding the vaporization is a low-cost and highly profitable way to add magnesium for ductile iron. Other major advantages include:

- *Higher percentage of magnesium recovery . . .*
- *Better analysis control . . .*
- *Less sparking, less smoke, less fume removal expense . . .*
- *Less slag, min., oxidation and cleaner iron . . .*
- *Lower, over-all alloying costs . . .*

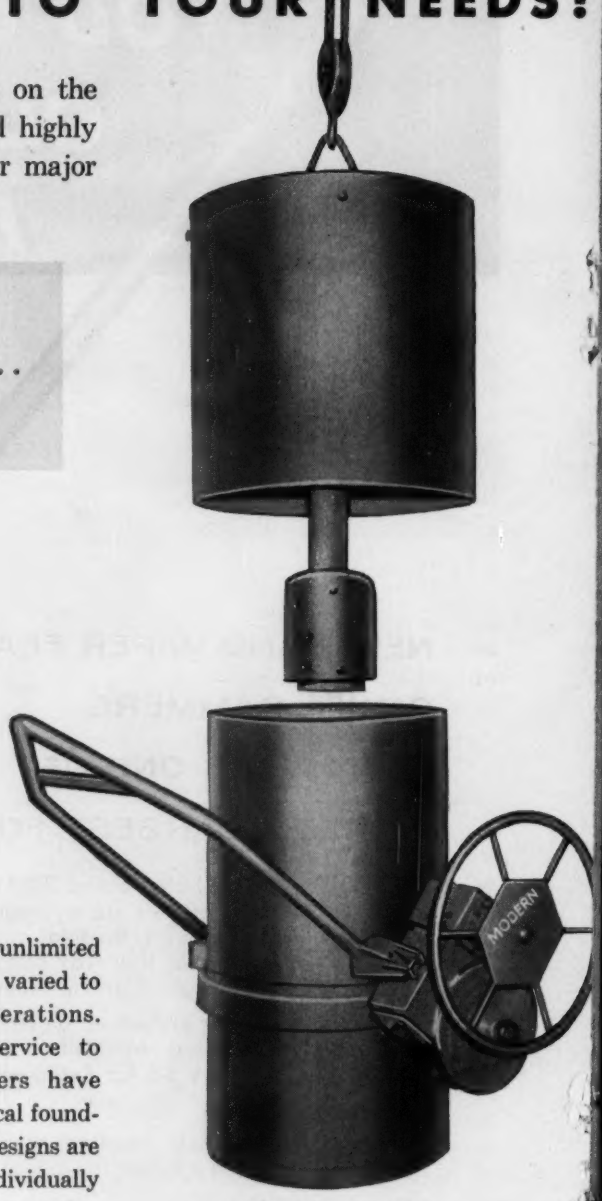


Inoculating ladle on transfer car. Three-motor operation — traverse, raising and lowering and ladle tilt.



Motorized, inoculating ladle to treat 3500 pounds of nodular. 22", free top space for reaction area.

Engineered, ladle designs and unlimited capacities, for plunging, may be varied to serve your individualized operations. Throughout our forty-year's service to foundries, MODERN engineers have worked hand in hand with practical foundrymen. Now, MODERN, ladle designs are unlimited! Capacities, too, are individually engineered to the needs of your pouring floors. There's less chilling, less pigging and the higher pay-loads boost your take at the weigh-out scales. LADLES UNLIMITED include ladles with manual control, motorized-tilt, transfer cars, etc.! You name it! We'll make it!



Inoculating ladle with skirt and plunger-bell.

Ask for CATALOG P-152-A

MODERN EQUIPMENT COMPANY

Dept. F-2, Port Washington, Wisconsin

REPRESENTATIVES IN ALL PRINCIPAL CITIES

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STEVENS LIQUID PARTING HELPS AMERICAN-Standard BUILD QUALITY INTO BATHTUBS!

BATHTUB CASTINGS MUST BE FLAWLESS to pass rigid final inspection at American-Standard — a name that's synonymous with quality in the plumbing fixture field.

To insure more perfect castings and fewer rejects, sand molds must come away clean from the patterns. Stevens Liquid Parting assures the best detail in final castings by completely covering the pattern with a tough, lasting film.

For best casting detail, maximum number of molds per application and fastest, most economical mold preparation, start using Stevens Liquid Parting in your foundry operation now. See for yourself why it's the world's largest-selling Liquid Parting. Call your local Stevens representative or write for complete information.

EVERYTHING FOR THE FOUNDRY

frederic b. STEVENS, inc.

DETROIT 16, MICH.

BUFFALO CHICAGO DETROIT CLEVELAND
INDIANAPOLIS MILWAUKEE NEW HAVEN SPRINGFIELD (OHIO)

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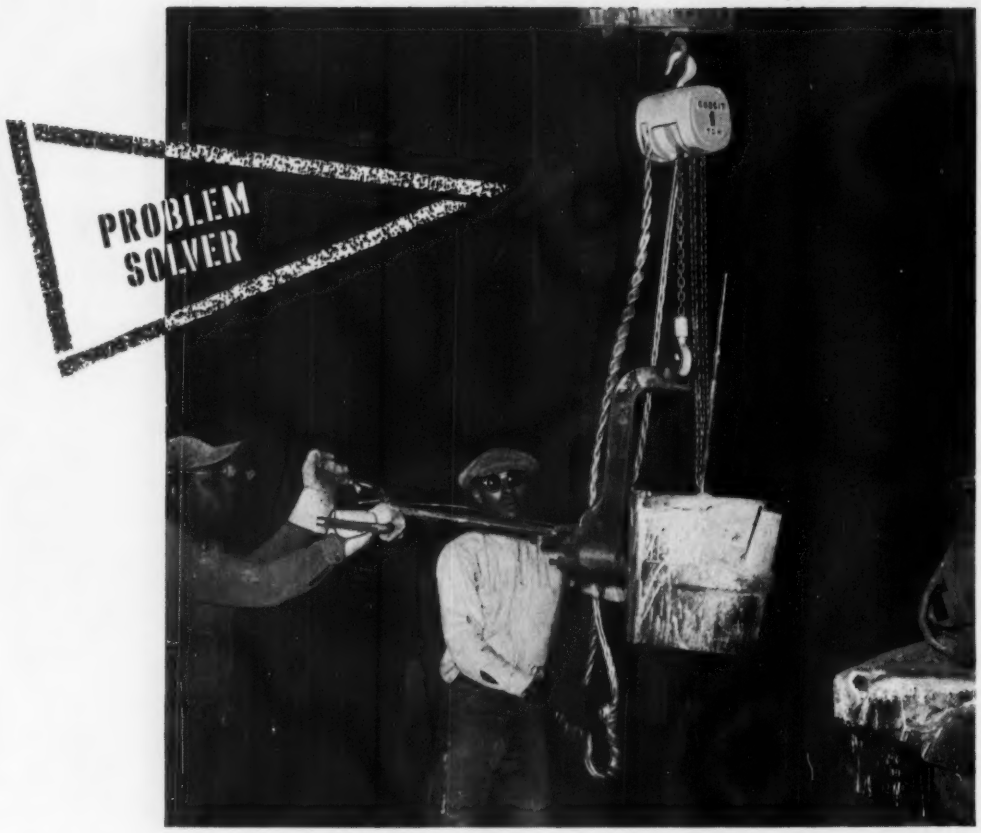
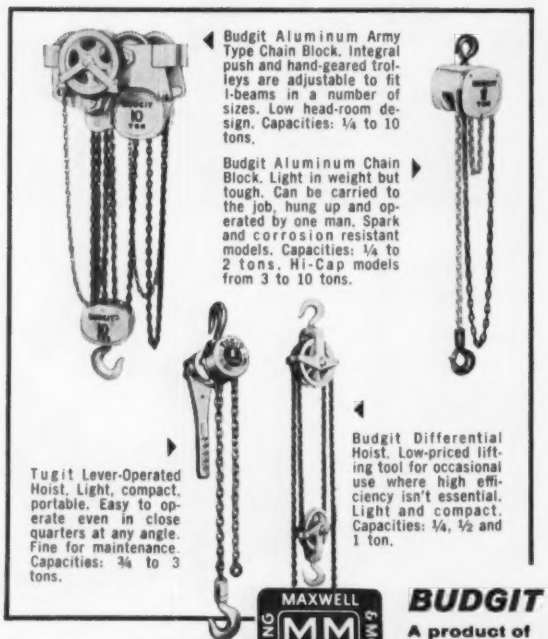


Pouring efficiency boosted with Budgit® Chain Block



Budgit Aluminum Army Type Chain Block. Integral push and hand-geared trolleys are adjustable to fit I-beams in a number of sizes. Low head-room design. Capacities: ¼ to 10 tons.

Budgit Aluminum Chain Block. Light in weight but tough. Can be carried to the job, hung up and operated by one man. Spark and corrosion resistant models. Capacities: ¼ to 2 tons. Hi-Cap models from 3 to 10 tons.

Tugit Lever-Operated Hoist. Light, compact, portable. Easy to operate even in close quarters at any angle. Fine for maintenance. Capacities: ¾ to 3 tons.

Budgit Differential Hoist. Low-priced lifting tool for occasional use where high efficiency isn't essential. Light and compact. Capacities: ¼, ½ and 1 ton.

60 C-2

Foundry dirt and grit can raise havoc with hoisting equipment. That is why this producer of small castings invested in a 1-ton Budgit Aluminum Chain Block for ladle pouring. The external load brake on the old-style hoist formerly used collected dirt and grit, then locked-up, causing pouring delays. Muscle straining hand chain pull added to the tough work on every lift.

The sealed-in mechanism on the Budgit Chain Block eliminated load brake maintenance and work stoppage. Efficient equa-torque gearing eases hand chain pull so much, hoisting operations take little effort, and control is so accurate the ladle can be quickly inched into position.

In foundries, areas where the air is dense with dirt and grit, and ambient temperatures run high, the use of Budgit Chain Blocks provides the most desirable performance without costly maintenance problems. For complete information about these modern hoists, call your nearby Shaw-Box Distributor or write for Bulletin 16010-12A.

BUDGIT CHAIN BLOCKS

A product of

MANNING, MAXWELL & MOORE, INC.

Shaw-Box Crane & Hoist Division • Muskegon, Michigan
In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

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